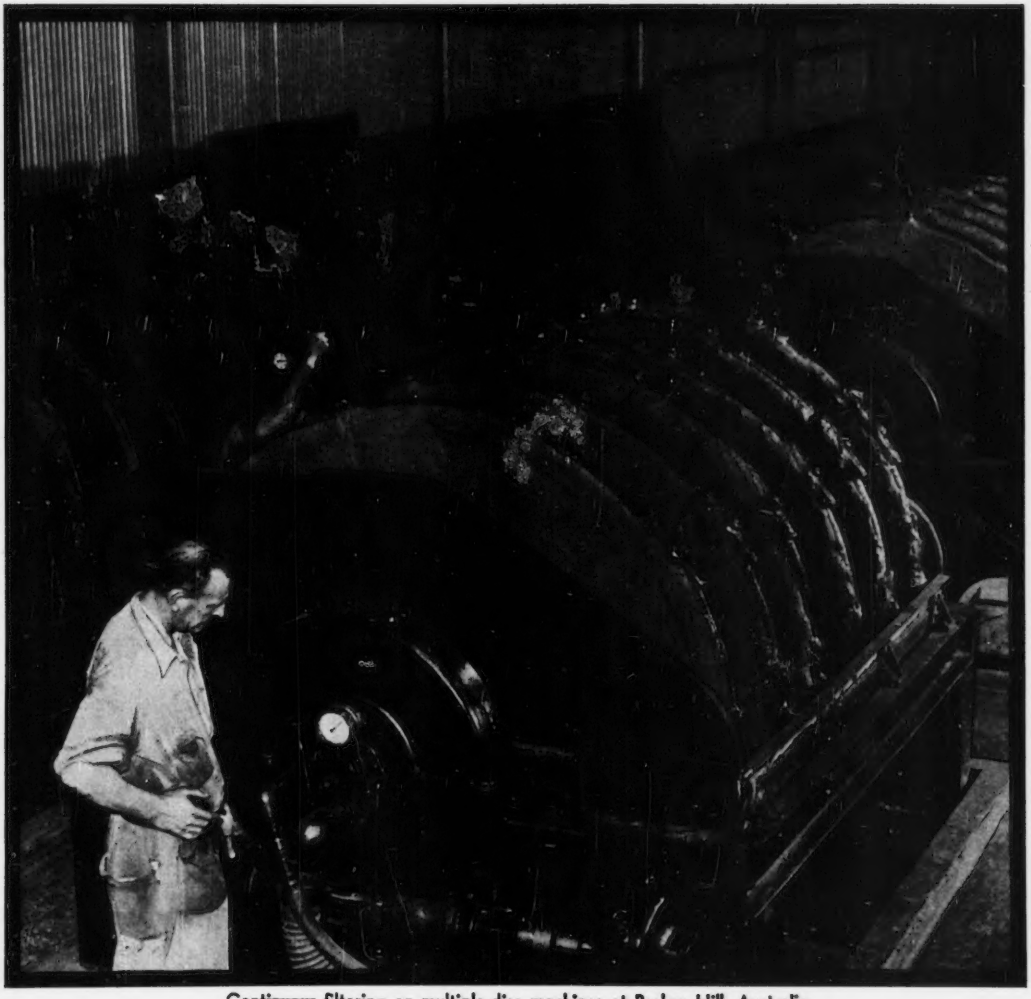
ENGINEERING AND MINING JOURNAL

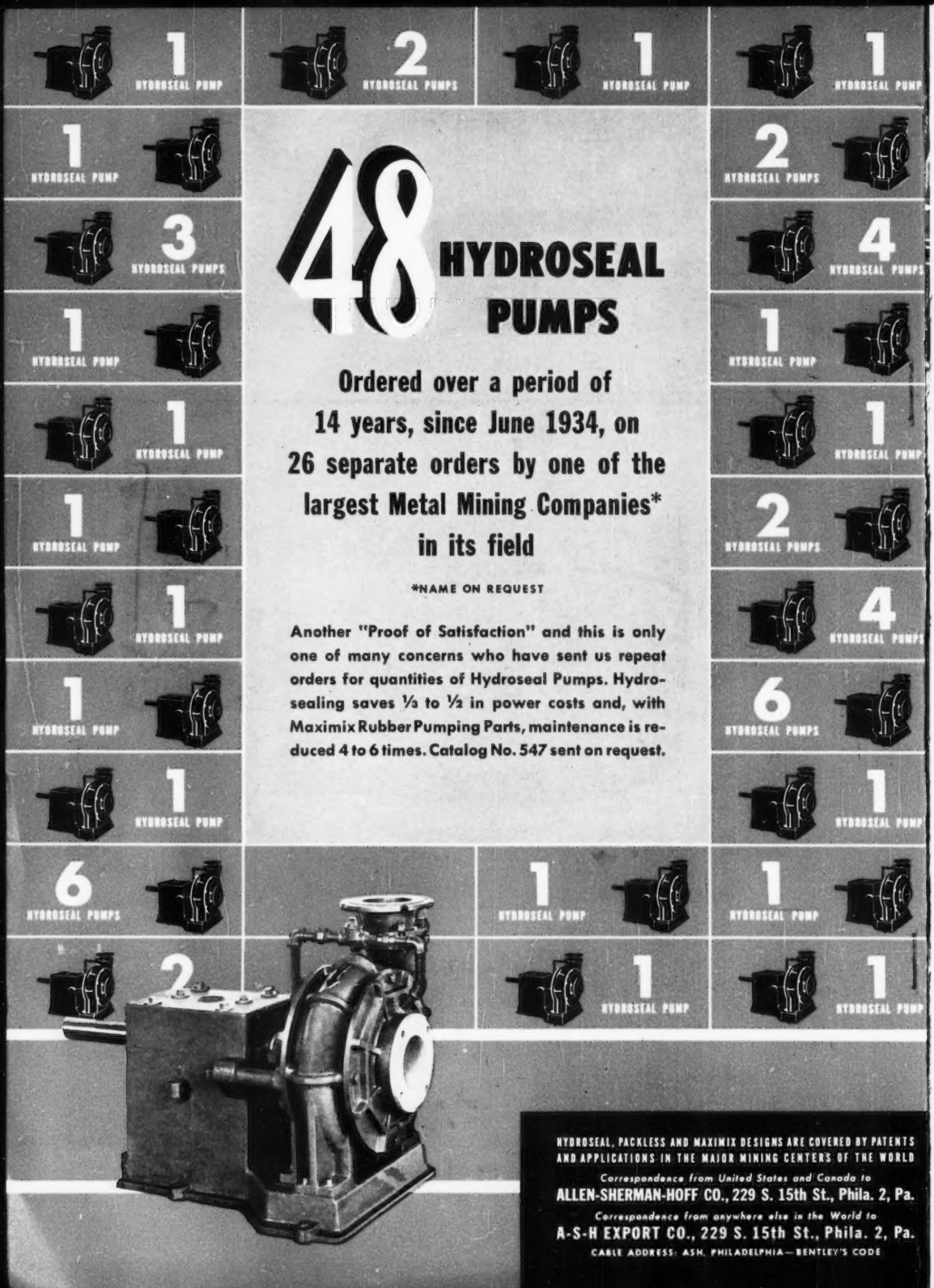
A McGRAW-HILL PUBLICATION

JANUARY, 1949



Continuous filtering on multiple-disc machines at Broken Hill, Australia

Sand-Slime Filling of Stopes—Page 54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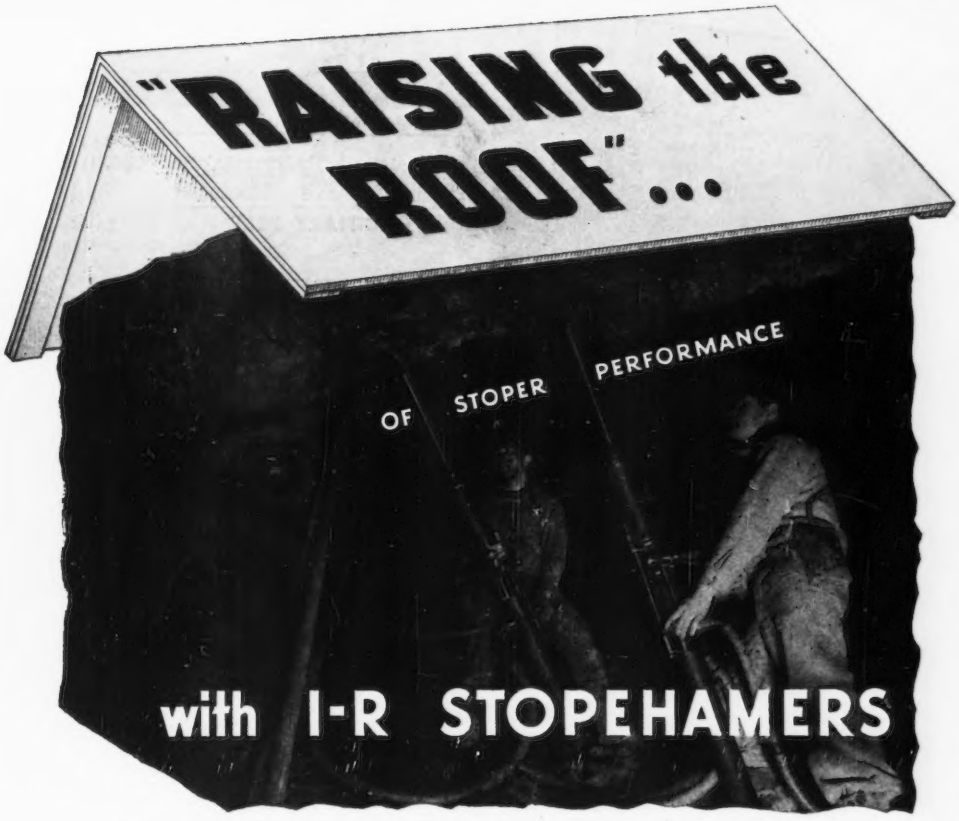

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FEED TRAVEL, IN.	24 15/16	25
STEEL CHANGE, IN.	18	18

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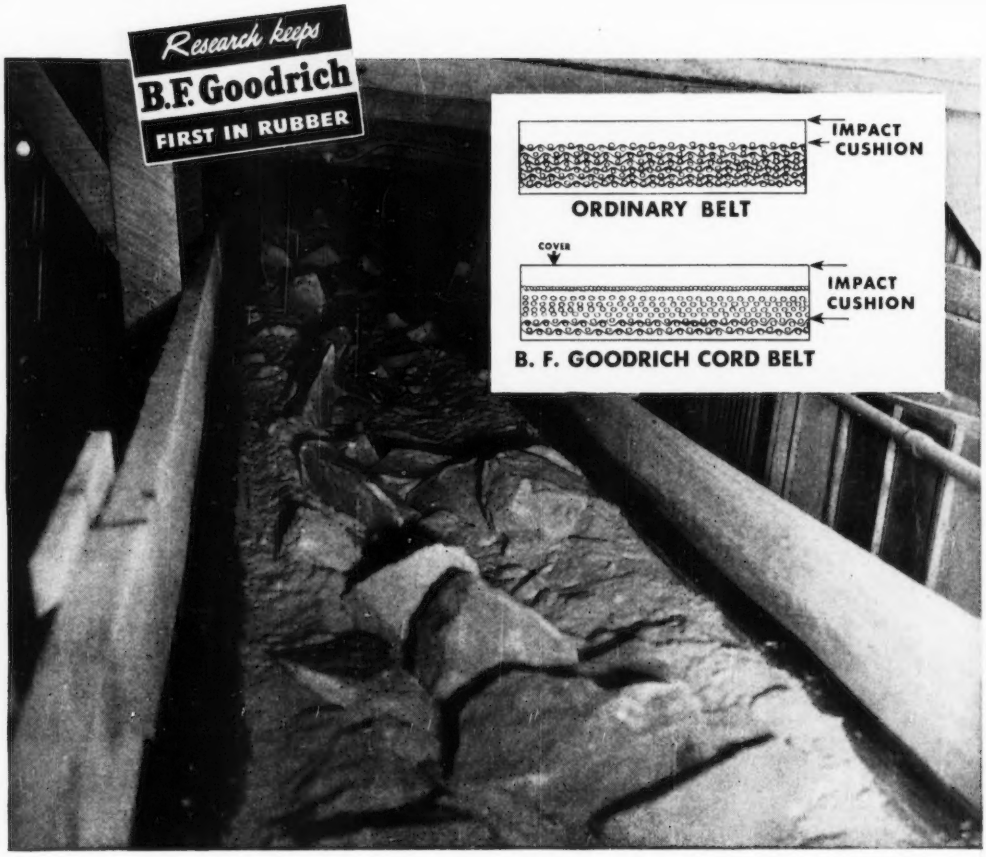

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ENGINEERING AND MINING JOURNAL

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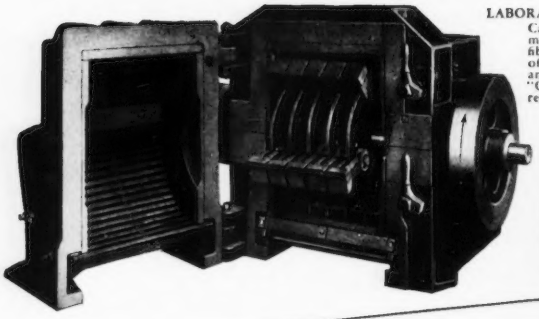

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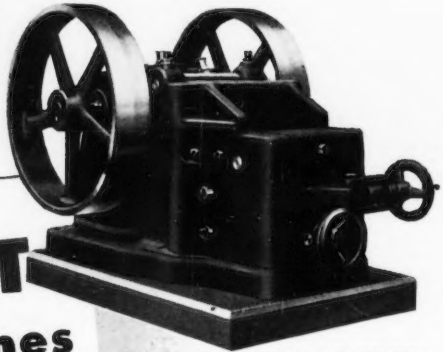

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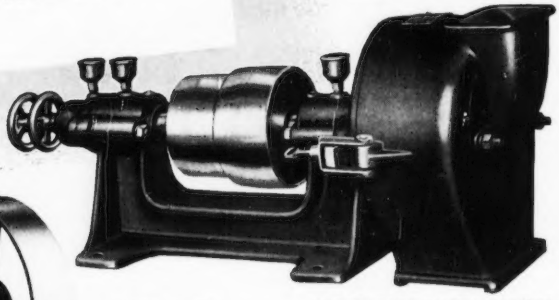

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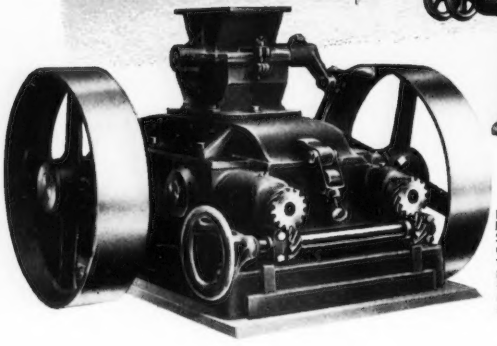

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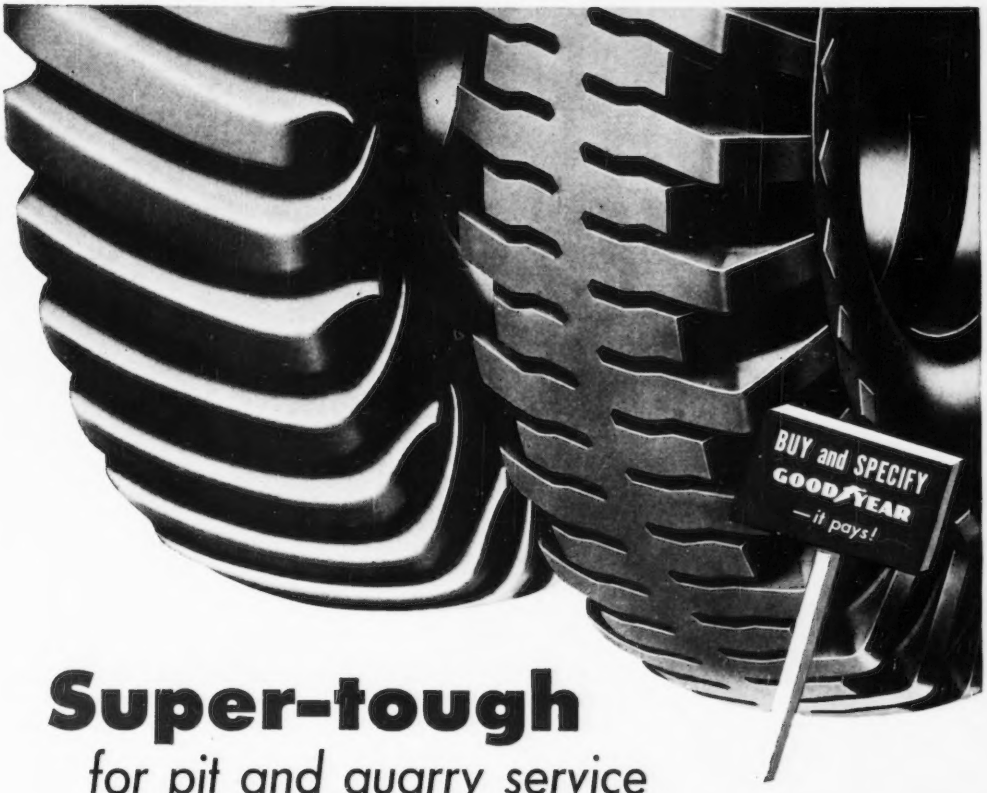

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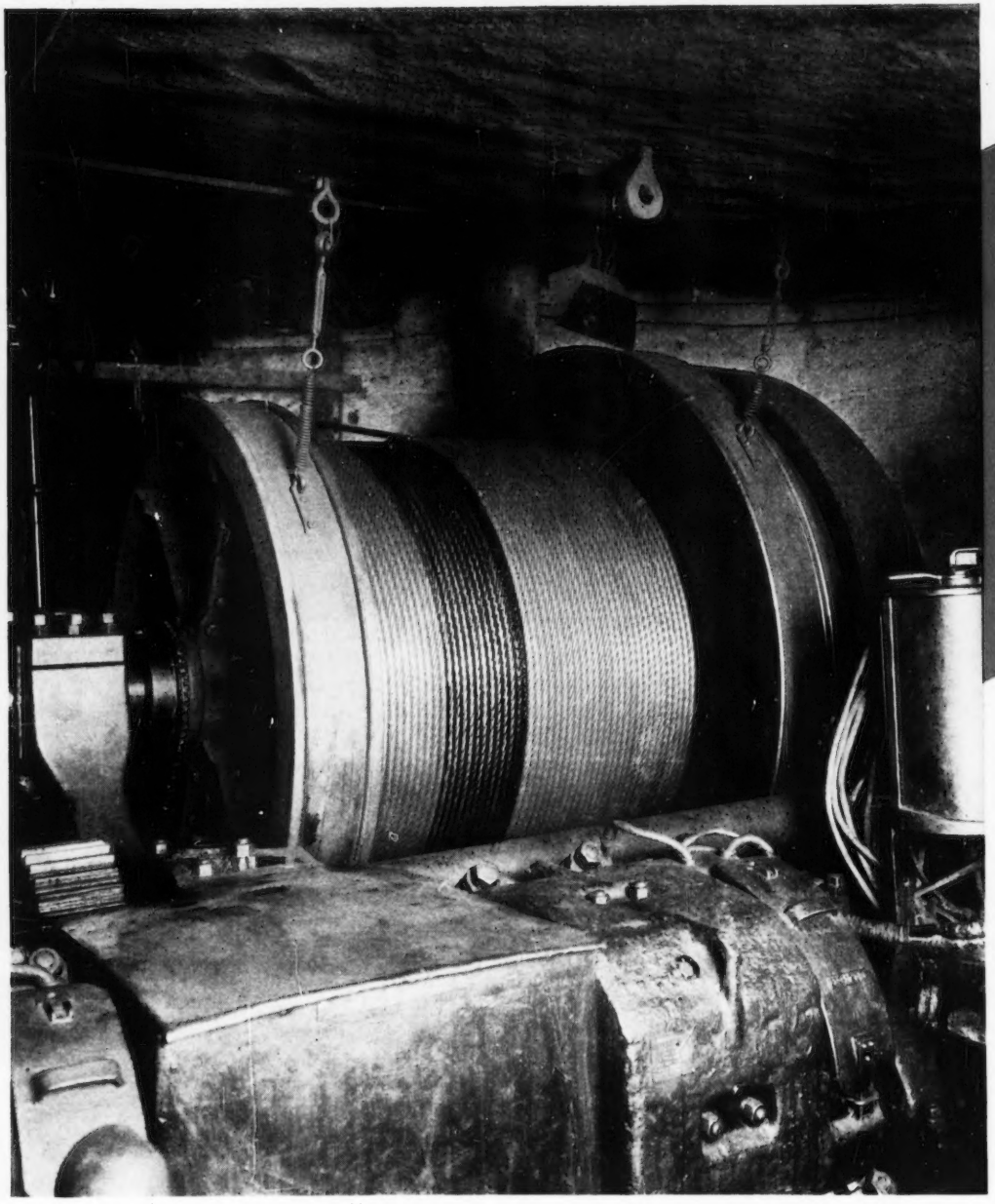

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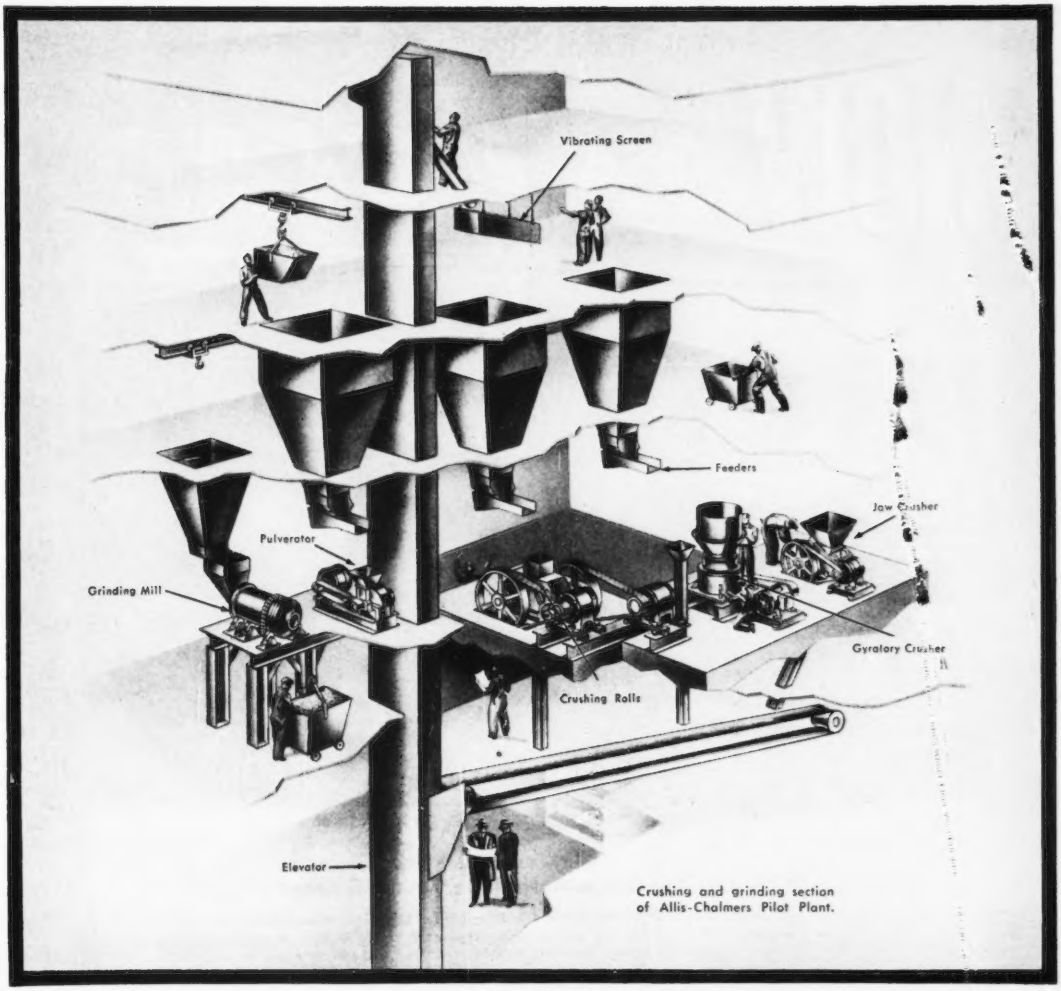

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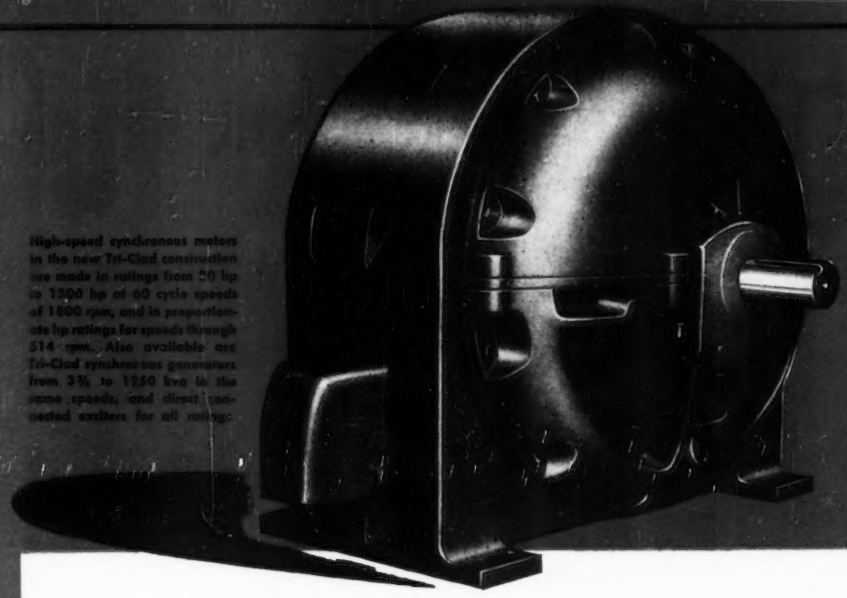

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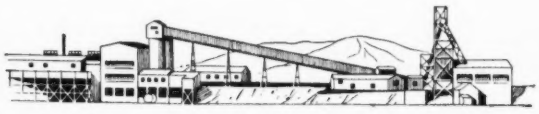

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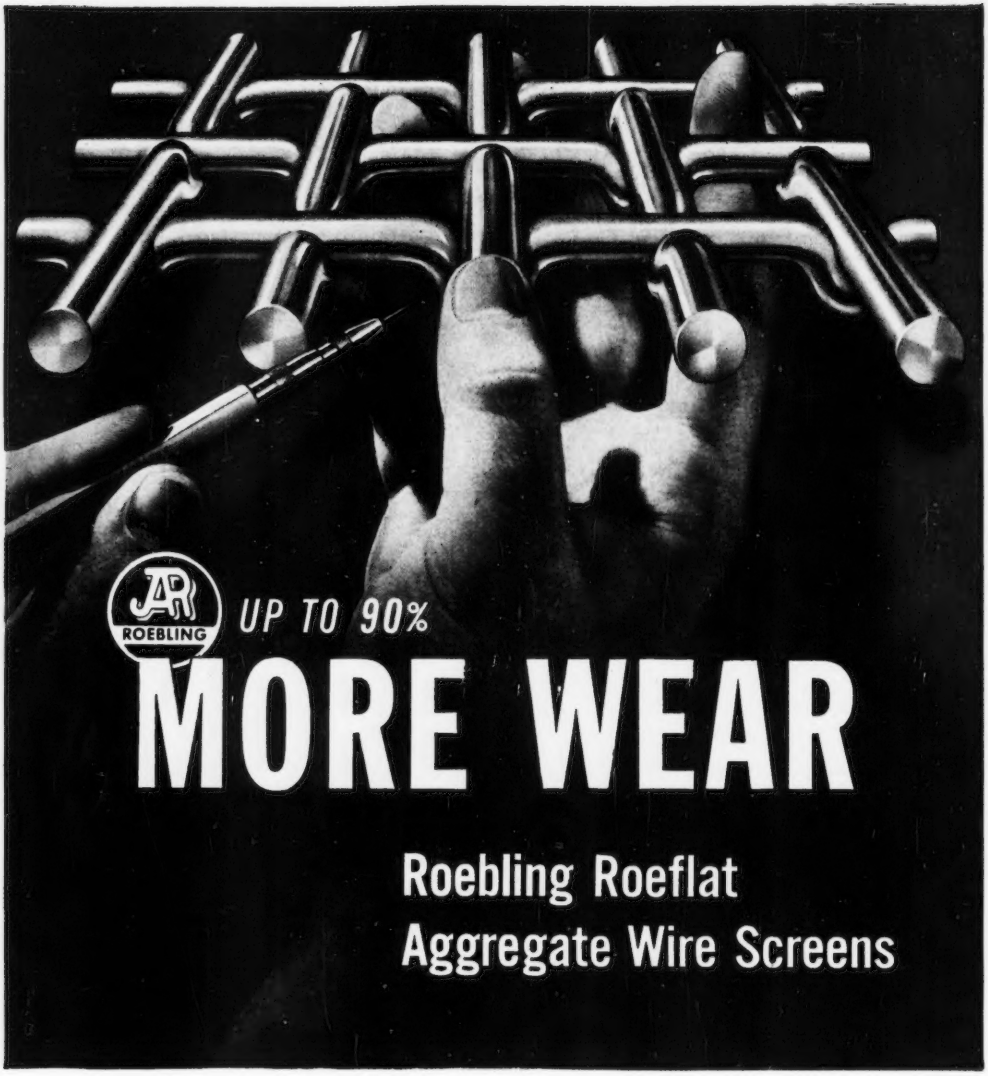

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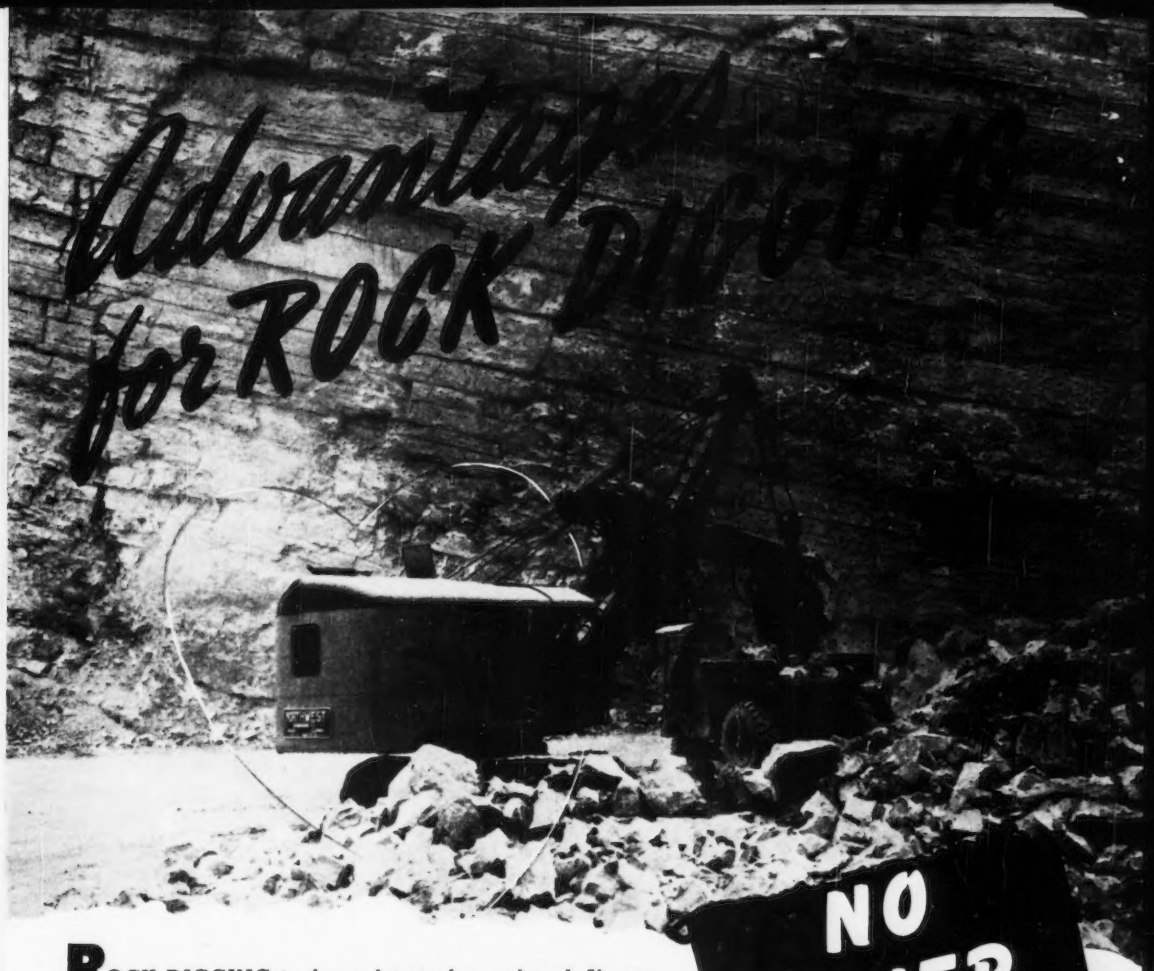

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Convertible for any Mining Material Handling or Excavation Problem

5 PITS serviced by West Virginia–

THE West Virginia-Pittsburgh Coal Company is using a high-speed, rubber-tired C Tournadozer to maintain five widely separated pits of the Locust Grove mine at Collier, W. Va. Tournadozer cleans up around 5 shovels in the 5 pits, cleans the coal seam in each, levels spoil, clears snow from haul roads and works as an all-round utility dozer . . . travels job-to-job and pit-to-pit at 15 m.p.h.

5 hour Crawler trip in 30 min.

Track-type tractors, required 5 hours to travel from pit # 5 to tipple over back roads open to crawler use. ***Tournadozer, traveling a shorter route ...8 miles...via macadam roads, makes this trip in 30 minutes.***

Owner says *TOURNADOZER* handles 50% more spoil

F. A. Howe, owner, says, "For our kind of work, it does a good job anyplace we put it . . . will doze about 50% more spoil than a crawler. Last winter it did a swell job cleaning a 10-inch snow from our roads . . . in considerably less time than a tractor. Due to its speed and mobility, it can work all of our pits . . . saves us one to two tractors."

Operator likes its speed... comfort

J. Ross Denham, of St. Clairsville, Ohio, likes the easy-riding 180 h.p. Tournadozer. "You don't get that 'old jar' . . . it's fast on dozing spoil . . . can make 1½ cleaning passes to a dozer's one.

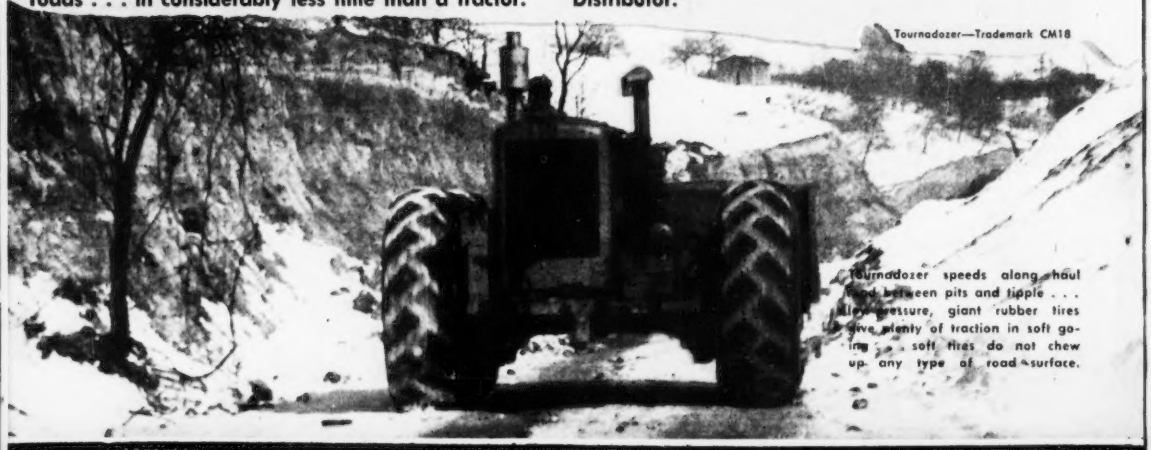
"I like the easy greasing too . . . been operating crawler dozers for 20 years and I like everything about Tournadozer . . . it's sure easy to handle . . . you can be gone while a tractor is changing gears."

Faster on any dozing job

Because of the Tournadozer's high speed, instantaneous shift, faster dozing speeds, faster reverse speeds, you get more work cycles per hour on stripping overburden, haul road maintenance or any dozing job. Because of its faster travel speed on rubber the Tournadozer handles more jobs per day.

For complete information on the revolutionary rubber-tired dozer, contact your nearest LeTourneau Distributor.

Tournadozer—Trademark CM18

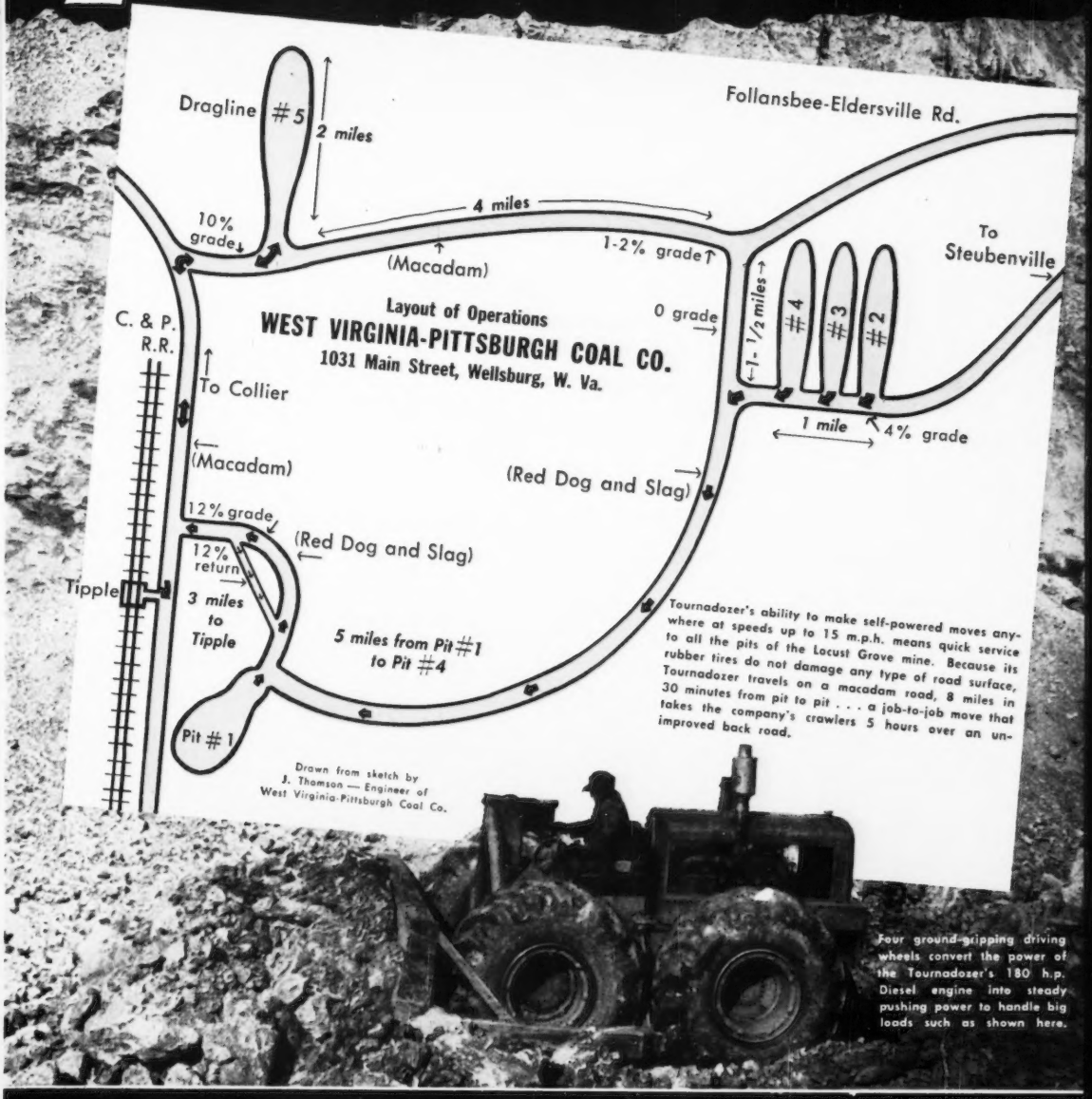


Tournadozer speeds along haul road between pits and tipple . . . low pressure, giant rubber tires give plenty of traction in soft going . . . soft tires do not chew up any type of road surface.

LETOURNEAU LET EQUIPMENT

It's RUBBER THAT PUTS THE ACTION IN TRACTION . . . See your LeTourneau Distributor NOW for complete information

1 TOURNADOZER at Pittsburgh Coal Co.



Tournadozer's ability to make self-powered moves anywhere at speeds up to 15 m.p.h. means quick service to all the pits of the Locust Grove mine. Because its rubber tires do not damage any type of road surface, Tournadozer travels on a macadam road, 8 miles in 30 minutes from pit to pit . . . a job-to-job move that takes the company's crawlers 5 hours over an unimproved back road.

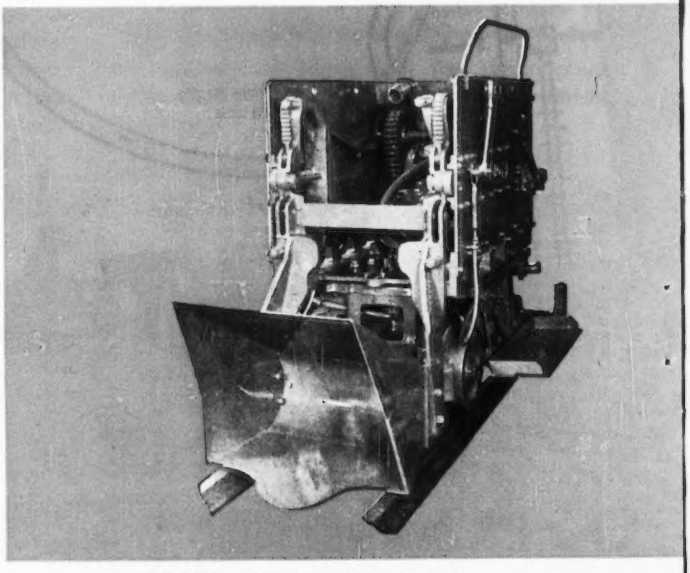
Four ground-gripping driving wheels convert the power of the Tournadozer's 180 h.p. Diesel engine into steady pushing power to handle big loads such as shown here.

LE TOURNEAU
PEORIA, ILLINOIS
HIGH-SPEED RUBBER-TIRED
TOURNADOZERS

"One of the best pieces of equipment on the job!"

That's what users say about

JOY SHOVEL LOADERS



The JOY HL-20 Shovel Loader for large drifts. Can load up to 3 tons per minute using cars from 50 to 90 cu. feet capacity.

The JOY HL-3 Shovel Loader for small drifts. Can load up to 2 tons per minute.

Note these Superior Features

They mean Lower Maintenance—Faster Loading at Less Cost—Greater Flexibility

- automatic CENTERING DEVICE, an exclusive JOY feature. Quickly and easily adjusted to have centering take place at any point in the loading cycle. Makes loading under inclined walls easier, and gives a longer, straight throw back into the car.
- SUPERIOR CONSTRUCTION . . . truck frame, gear case, and bumper are all combined in one heavy alloy casting for perfect alignment of all parts.
- exclusive "PISTONAIR" MOTORS . . . give greater power for loading and tramming, and provide better air economy.
- a LUBRICATION SYSTEM that is simple, yet provides ample lubrication for all moving parts.
- adjustable ROCKER-ARM LEVERAGE, another exclusive JOY feature. By changing position of lifting chains, the loader can load either long or short cars by changing discharge speed of bucket.

Consult a Joy Engineer

WRITE FOR BULLETIN

W&D M2093

JOY MANUFACTURING COMPANY

GENERAL OFFICES: HENRY W. OLIVER BUILDING · PITTSBURGH 22, PA.

IN CANADA: JOY MANUFACTURING COMPANY (CANADA) LIMITED, GALT, ONTARIO

Proof of the DURABILITY of MARCY MILLS

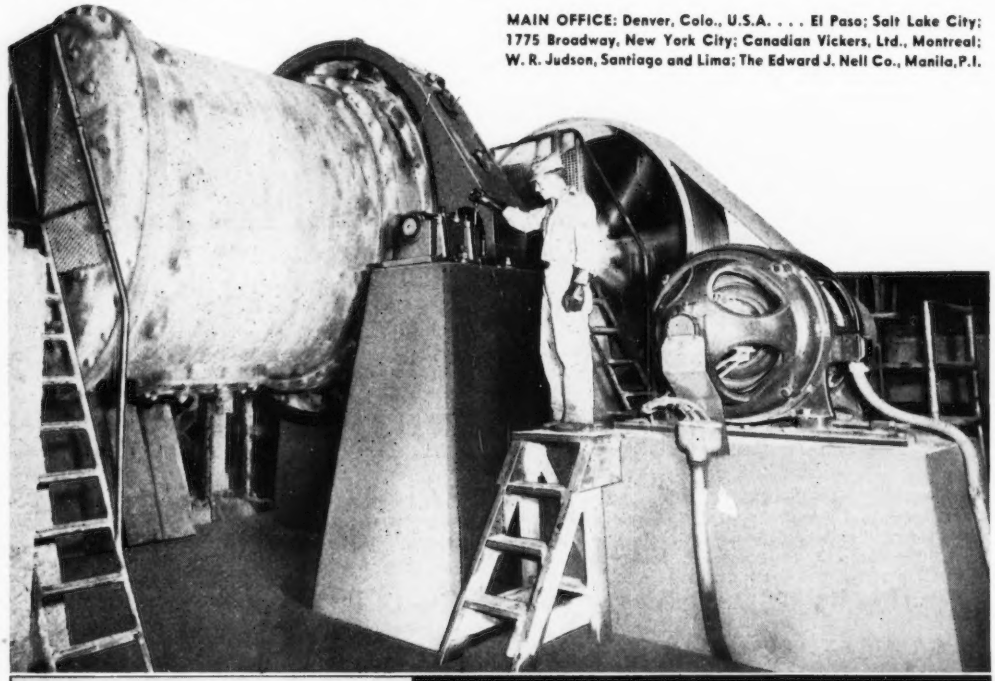
This MARCY Ball Mill was bought in 1937 by a large American mining Corporation and installed in one of their existing operations. When a new milling plant was opened during World War II, this MARCY was moved in as original equipment — and is still going strong.

When a Ball Mill's history covers two different plants, it is ready to join the class of many MARCY Ball Mills installed in 1915 and still operating economically, showing proof of the heavy design with ability to keep going year after year.

Open end grate discharge provides quicker removal of the finished product without wasteful overgrinding. MARCY Design provides many times as much discharge opening as conventional trunnion overflow mills. Cushioning is less, impact drop is greater, pulp density much higher, Finished material discharges automatically when finished. These gains add up to more tonnage, lower per ton costs, and improved metallurgy throughout the flowsheet.

Marcy Ball and Rod Mills are built in types and sizes to meet every ore milling requirement. "Mine and Smelter's" metallurgical experience is at your service. Your inquiry will be given immediate, competent attention.

MAIN OFFICE: Denver, Colo., U.S.A. . . . El Paso; Salt Lake City; 1775 Broadway, New York City; Canadian Vickers, Ltd., Montreal; W. R. Judson, Santiago and Lima; The Edward J. Nell Co., Manila, P.I.



Massco Fahrenwald Flotation Machines; Genuine Wilfley Tables; Massco-McCarthy Hot Millers; Rock Bit Grinders; Density Controllers; Belt Feeders; Pinch Valves; Assay and Laboratory Supplies and Equipment; Complete Milling Plants; Constam Ski Lifts.

The Mine & Smelter Supply Co.

HE'S NOT guessing..HE knows!

"We've used 'Caterpillar' equipment for the past 25 years and know it does an excellent job."

Supt. W. G. EMMINGER,
Nevada-Massachusetts Co., Tungsten, Nev.

A "Caterpillar" Diesel D6 Tractor sets a fast pace in the pit. Equipped with Traxcavator, it scoops up heavy tungsten ore and loads a 5-yard truck in 3 scoops in 3 minutes.

TWENTY-FIVE years is a long time—and in that time "Caterpillar" Diesel equipment has proved itself economical and versatile to the Nevada-Massachusetts Co., the largest tungsten mine in the U.S.A. It lists on its roster two D6 tractors (one with Traxcavator) . . . one Diesel Fifty . . . one D4 . . . two D4600 engines in shovels . . . and two veteran "Caterpillar" spark ignition tractors.

Here you see the D6 with the 1¾-yard Traxcavator bucket in action. It fills a 5-yard truck with the heavy ore in 3 scoops – in as little as 3 minutes.

Supt. Emminger adds: "This D6 with Traxcavator is doing a great job under tough conditions. Its mobility enables us to service many stockpiles. Its easy handling and good control make it easy on the operator."

CATERPILLAR TRACTOR CO., PEORIA, ILLINOIS

CATERPILLAR DIESEL
REG. U. S. PAT. OFF.

ENGINES • TRACTORS
MOTOR GRADERS
EARTHMOVING EQUIPMENT

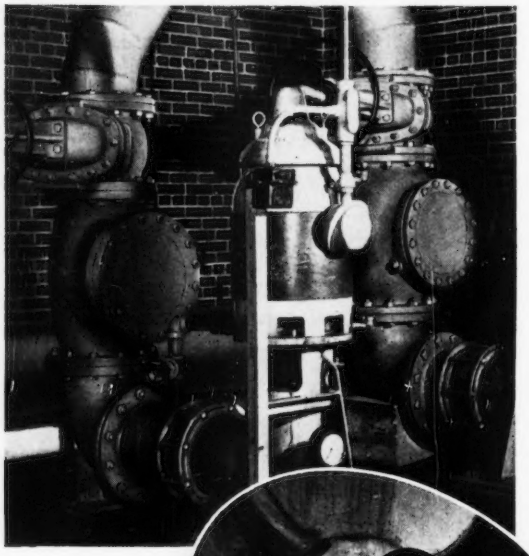
For complete selection in mine piping ..."Get it from CRANE"

ONE SOURCE OF SUPPLY
RESPONSIBILITY
STANDARD OF QUALITY

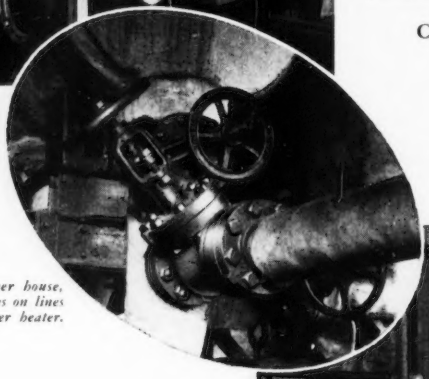
There is no easier, no more certain way to get the piping you need for power, process or general service mine installations. One order to Crane—through conveniently located Branches and Wholesalers—brings you the world's most complete selection of valves, fittings, pipe and accessories. One catalog gives you an unequaled choice of the best in brass, iron, steel and alloy materials.

Why not do as many leading mines have done and standardize on Crane? It is **One Source of Supply** broad enough to simplify all piping procedures, from design to erection to maintenance. **Undivided Responsibility** for materials helps you get better installations, avoids needless delays on the job. And for the **Highest Quality** in every item that makes for dependable piping performance—get it from Crane.

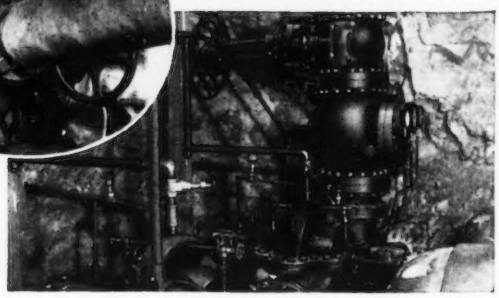
CRANE CO., 836 S. Michigan Ave.
Chicago 5, Ill.
Branches and Wholesalers
Serving All Industrial Areas



CRANE *Iron Body Gate and Check Valves on mine pumping installation.*



IN COPPER MINE *power house, Crane Steel Gate Valves on lines to closed feed hot water heater.*



IN A SILVER MINE, *Crane equipment includes 12-in. Ferrosteel Gate and Check Valves. Also brass, globes, angles and checks.*

EVERYTHING FROM . . .

VALVES
FITTINGS
PIPE

CRANE

PLUMBING
AND
HEATING

FOR EVERY PIPING SYSTEM

Choose Between Them and Get 30% to 100% More Air

Coppus Blowers are designed for two different types of mine ventilation requirements: the centrifugal Coppus VENTAIR is for long pipe lines; the propeller-type Coppus VANO for shorter lines . . . the correct selection will give you from ⅓ more to twice as much air — for a given power consumption — than an ordinary all-purpose fan.

Available for either compressed air or electric motor drive, both can be used as blowers or exhausters and are obtainable in capacities up to 90,000 CFM.

Only Coppus makes both these types, one of which will give you better, more economical mine ventilation . . . know them by the "Blue Ribbon" that symbolizes the engineering and production skill behind every Coppus product.

Representatives listed in METAL and NON-METALLIC MINING CATALOGS. Other Coppus "Blue Ribbon" products: steam turbines, gas burners, heat killers, air filters, blowers and exhausters for special purposes. See also THOMAS' REGISTER...Coppus Engineering Corporation, Worcester 2, Massachusetts.

COPPUS ENGINEERING CORPORATION
281 Park Avenue, Worcester 2, Mass.

Please send.....Bulletin 130

Name.....

Company.....

Address.....

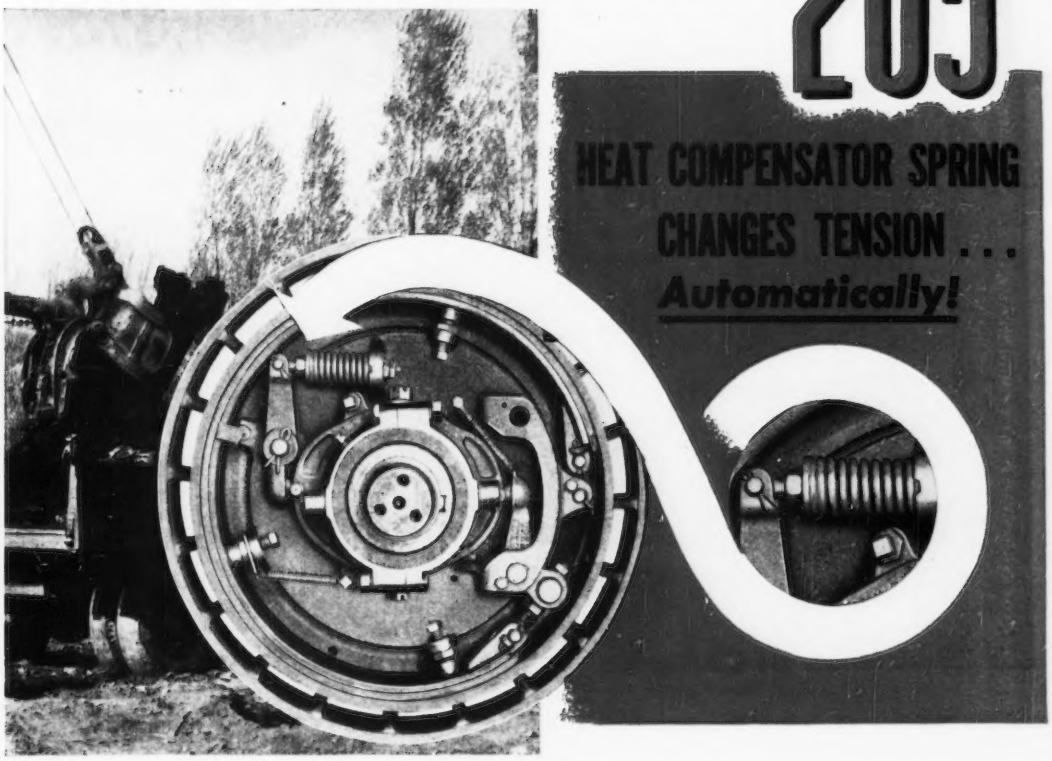
NO time-out for CLUTCH ADJUSTMENTS

KOEHRING DUMPTORS* have the same heavy-duty qualities and big-production ability as Koehring excavators . . . combined, they give you matched excavating-hauling efficiency. Rugged 6-yard rock body . . . plus a ton of Dumptor strength for every ton of payload, withstand severest shocks of shovel loading and roughest off-road hauling. Constant-mesh transmission and 3 fast speeds, forward and reverse, provide no-turn shuttle hauling. 1-second gravity dump saves more time every trip.

*Trademark Reg. U. S. Pat. Off.

KOEHRING COMPANY
Milwaukee 10, Wisconsin
Subsidiaries: JOHNSON • PARSONS • KWIK-MIX

with KOEHRING HALF-YARD 205



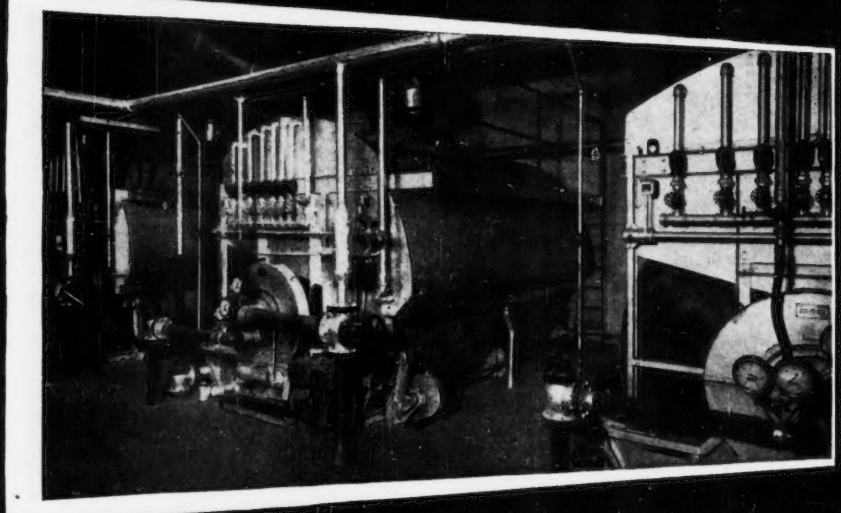
With Koehring ½-yard 205, there's no time-out for continuous manual clutch adjustments. It's no longer necessary for operator to tighten cold clutches when he starts in the morning, or between shifts . . . then loosen them again when clutches warm up. Large compensator springs on the 205's main drum (above), swing and traction clutches automatically make all tension changes . . . maintain full clutch efficiency. No "compromise" settings . . . you get top production all through the shift . . . have accurate, smooth control at all times. Gives you bigger daily yardage as shovel, dragline or pull shovel . . . is equally important on clamshell and heavy lift crane service, where you have intermittent usage.

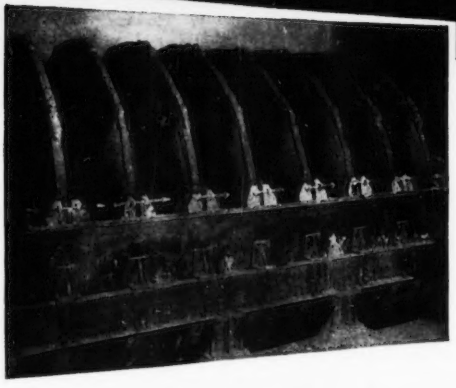
Also, with Koehring 205 you get double-fulcrum control linkage on crowd-retract and traction that eliminates overtravel, drag and chatter . . . independent traction, to travel, swing and operate boom all at same time . . . full choice of crawler, truck or cruiser mounting to best fit your operating requirements. Your local Koehring distributor can show you many other 205 features that will save time and assure more production at lower cost on your work. See him *today*.

K900

OTHER KOEHRING EXCAVATOR SIZES: ¾ yd. 304 • 1½ yd. 605 • 2½ yd. 1005

IT PAYS TO USE *Morse* FILTERS





PARAMOUNT IN EFFICIENCY AND MECHANICAL DEPENDABILITY

Drum and Disc Filters—Fully Automatic and Continuous in Operation. Manufactured in a large variety of sizes. Precise in manufacture and correct in design to perform with lowest cost per ton of material filtered. Drum Filters from nine to five hundred and Disc Filter from twenty-two up to eight hundred square feet filter surface for all characters of general dewatering and filtering problems.

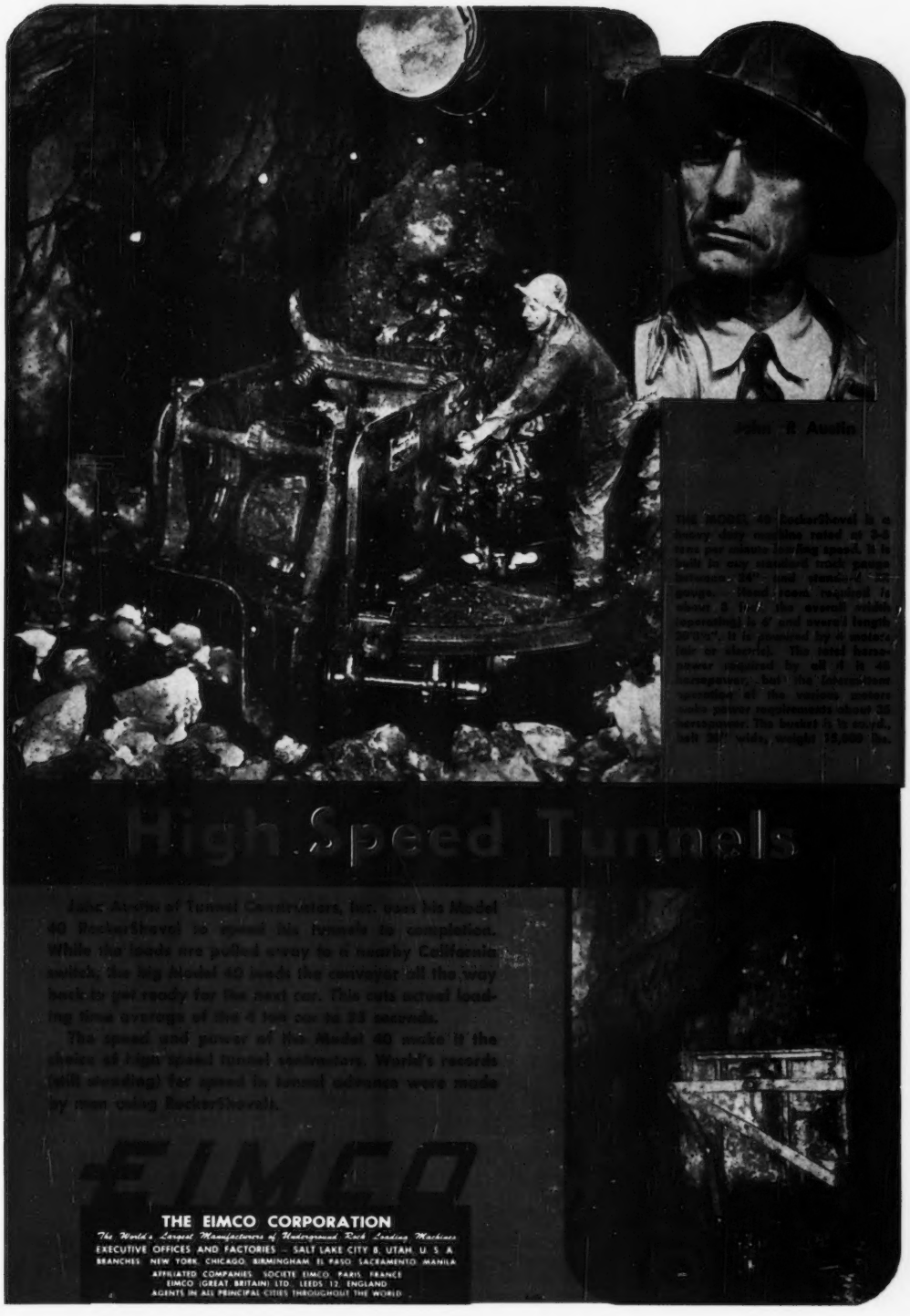
Bulletin No. 4710 upon request

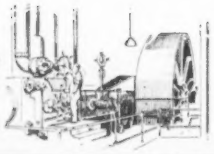
MB

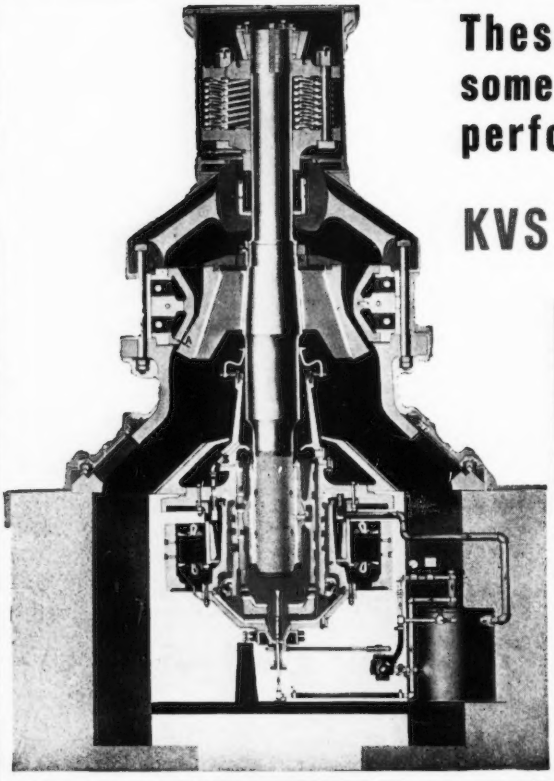
MORSE BROS. MACHINERY CO.

ESTABLISHED 1898

P. O. BOX 1708 • DENVER, COLORADO, U. S. A. • CABLE "MORSE"


John B Austin
High Speed Tunnels
EIMCO
THE EIMCO CORPORATION
The World's Largest Manufacturers of Underground Rock Loading Machines
EXECUTIVE OFFICES AND FACTORIES — SALT LAKE CITY 8, UTAH, U. S. A.
BRANCHES: NEW YORK, CHICAGO, BIRMINGHAM, EL PASO, SACRAMENTO, MANILA
AFFILIATED COMPANIES: SOCIETE EIMCO, PARIS, FRANCE
EIMCO (GREAT BRITAIN) LTD., LEEDS, 12, ENGLAND
AGENTS IN ALL PRINCIPAL CITIES THROUGHOUT THE WORLD

Mr Corliss  had the RIGHT



These figures give you some idea of the mighty performance of

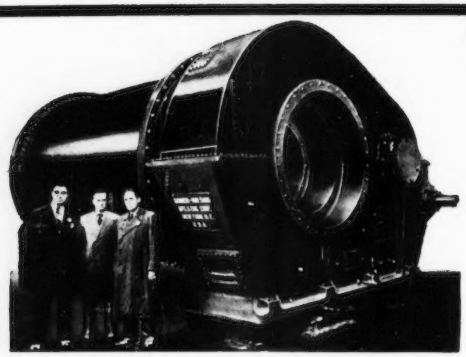
No. 37½ TYPE S

KVS GEARLESS CRUSHER

LOCATION: NATIONALLY KNOWN MINING CO. NEW YORK STATE
CRUSHERS: FOUR NO. 37½ KENNEDY TYPE "S" ROLLER BEARING GYRATORY CRUSHERS
FEED OPENING: 6¼"; **DIAMETER OF HEAD:** 3 FEET
DISCHARGE SETTING: 7/32" CLOSED SIDE AT HEAD
CAPACITY EACH CRUSHER: 56 TONS PER HOUR
HORSEPOWER EACH CRUSHER: 48 HP.
CLOSED CIRCUIT OPERATION
GRADATION AS FOLLOWS:

THE FIGURES!

99.8%	Minus	3	MESH
93.3	"	4	"
80.6	"	6	"
66.6	"	8	"
56.1	"	10	"
48.1	"	14	"
40.6	"	20	"



TWO right ideas cut costs in "KVS" Ball Mills

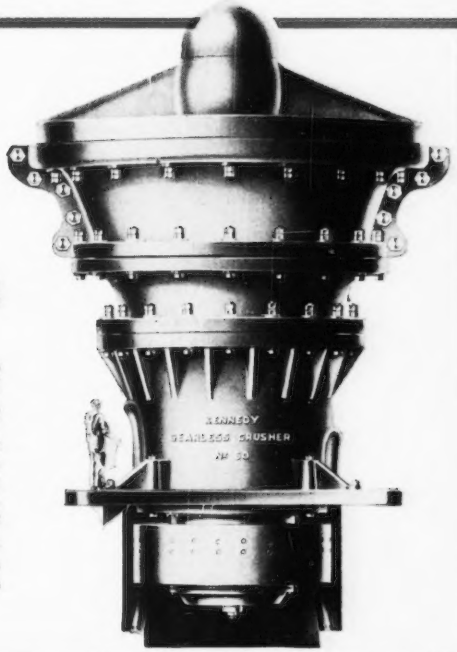
Idea No. 1 — the Kennedy INTEGRAL GEAR DRIVE enables motor to be DIRECT CONNECTED to driving shaft of this KVS Ball Mill. Shaft is carried in roller bearings that CANNOT be misaligned or set wrong. This is a sure safeguard against wasted power.

Idea No. 2—the "KVS" bearings on large sized tube and ball mills are carried on oil so that the bearing never wears out and uses little power. All gears and bearings are automatically sprayed with oil before the tube mill is started (Design patented). In 15 years no gears or pinions have worn out.

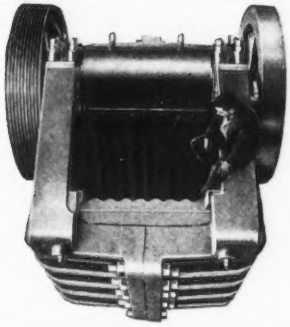
NO WONDER USERS SAY—"KVS PRODUCTS ARE

IDEA - *and* KVS *proves it!*

This idea pays off in MORE CRUSHING FOR LESS POWER COST *in this* "KVS" GEARLESS



You'll recall Mr. Corliss' idea—putting a big pulley on his engine. The pulley whirled around, creating KINETIC energy, which got more power from the steam. You see, you get ADDED POWER FOR NO ADDED COST when the big pulley in KVS Gearless Crushers whirls at a speed of 3,500 ft. per minute. What's more, the 8-ton pulley (as used in a KVS Crusher weighing 400,000 lbs.) can be turned WITH TWO FINGERS! That's because there are NO power-eating noisy gears in this KVS. If there was a bevel gear between the eccentric and the pulley, it would take six men with crowbars to turn it. In short, more CRUSHING for LESS POWER COST, is the KVS big idea for efficiency.



And the KVS "Swing Jaw" also proves a GREAT idea!

The idea is that you get BETTER CRUSHING in the KVS Swing Jaw Crusher—because both jaws "share the load." That's because the angle of both swing jaw and stationary jaw is the same. Stationary jaw carries fully 50% of the load—so you need LESS POWER to keep the swing jaw swinging and crushing. Another KVS idea is the swing jaw is all one piece, except renewable crushing plate. Also swing and stationary jaws are interchangeable, both the same length.

Kennedy-Van Saun
MANUFACTURING AND ENGINEERING CORPORATION
2 PARK AVE., NEW YORK 16, N. Y.
FACTORIES:
DANVILLE, PA., U.S.A.
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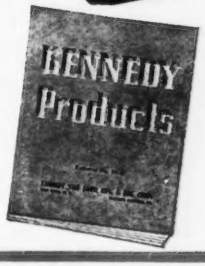
WRITE
For this "KVS" Bulletin. It gives complete technical data on "KVS" CRUSHERS—the facts you want before you invest good money.

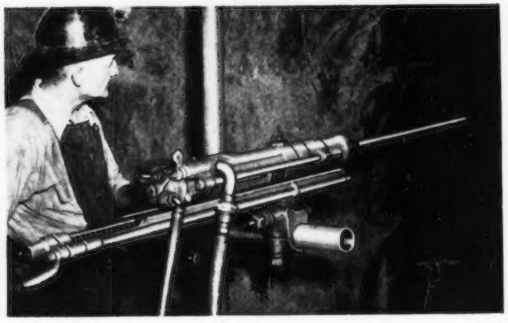


THE PRODUCTS WITH THE TROUBLES LEFT OUT"

Sinkers, Drifters, Diamond Drills—

CP Sinker Drill in operation at Benson Mines, Star Lake, N. Y.
Photograph through courtesy of Jones & Laughlin Steel Corporation.

There's a CP Sinker built for the job. For any type of sinker drilling there is just the right CP equipment, ranging from the light CP-22 to the heavy duty CP-60N. Especially suited for shaft sinking and other heavy-duty work in the harder formations, the CP-42 (55 pound class) is outstanding for fast drilling speed... strong rotation... exceptional hole cleaning.



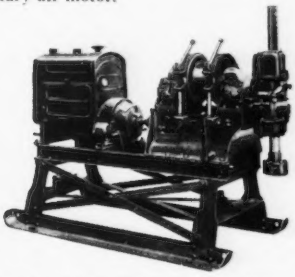
Built-in rotary feed motor shortens length — lightens weight. To its high drilling speed and powerful rotation, new design of CP-60N ROTORdrifter provides added advantages: shorter length... lighter weight... single air hose... drill and feed controls both in backhead... minimum working parts... smoother operation.

a complete rock drill line

The CP line of rock drills is complete . . . Sinkers for the lightest to the heaviest jobs — ROTOR-drifters with 3″ and 3½″ cylinder bore . . . Stopers for light and heavy duty . . . Air-powered and gasoline-driven Diamond Drills . . . Demolition Tools from the 25-pound to the 80-pound class. Whatever the job, you will find a CP drill expressly designed for it. Write for further information.

Unexcelled for hard abrasive formations. Where a heavy-duty stoper is needed for difficult drilling, the 120-pound CP-44 self-rotating Stoper offers exceptionally high drilling speed and rotative power . . . proper balance . . . powerful air blow . . . ease of control . . . low air consumption . . . minimum maintenance.

Packs 25% more power. While basically similar to the famous CP-5, the new CP-55 pneumatic Diamond Drill has 25% more power — without any increase in over-all weight — thanks to its newly designed rotary air motor.



For mineral prospecting from the surface. Tough operating conditions are taken in stride by the ruggedly built CP No. 8 gasoline-driven Diamond Core Drill. Skid-mounted, it is readily moved from hole to hole under its own power. With E-EX Fittings the CP No. 8 has a capacity of 900 feet. The CP No. 15 has a capacity of 1750 feet.

For really heavy work there's nothing faster. For dense concrete, and other extremely hard materials, no tool in the 80-pound class can match the CP-117 Demolition Tool. Valve-actuated, it strikes a tremendous blow — has no kickback and doesn't require "riding."

CHICAGO PNEUMATIC TOOL COMPANY

General Offices: 8 East 44th Street, New York 17, N. Y.

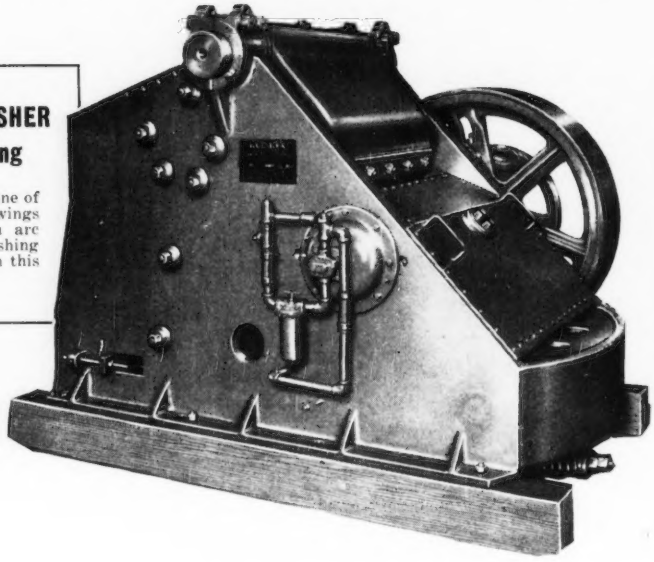
PNEUMATIC TOOLS • AIR COMPRESSORS • ELECTRIC TOOLS • DIESEL ENGINES
ROCK DRILLS • HYDRAULIC TOOLS • VACUUM PUMPS • AVIATION ACCESSORIES

LONGER CRUSHING LIFE

Higher Production with Less Power

***KUE-KEN SIMPLEX CRUSHER**
Crushes without rubbing

THE hinge pin is on the center line of the crushing zone. As the jaw swings back and forth it describes an arc which is normal to both crushing faces. *Rubbing* is impossible with this motion.



Illustrated: Rear view of a #80 36"x12" KUE - KEN Simplex showing oil pump and filter. Perfect lubrication of all mechanism in oil-tite housing stops wear. Crushes 50 to 60 tons per hour at 1" setting.

Here's why Kue-Ken Simplex gives higher production at lower cost: Balanced mechanism permits 50% to 60% more crushing strokes per minute. Crushing done by compression alone, less power required. Jaw plates last 5 to 10 times longer. Less wear means fewer shut-downs for repair . . . more production, higher profits. Crushing without rubbing gives minimum metal contamination, vital in some industries.

1. Has simple safety device which protects crusher against tramp iron and overload.
2. Only light foundation required because of built-in smooth running features of Kue-Ken design.
3. Automatic oil pressure switch stops crusher and motor if oil pressure drops below normal setting.
4. All mechanism sealed in oil. Lubrication required only twice a year.

KUE-KEN CRUSHERS are operating throughout the world. Write today for Bulletin No. 605. You, too, can *pulverize* your crushing costs.

Licensed manufacturer for Eastern U. S., Canada and Puerto Rico: Pennsylvania Crusher Co., Broad & Arch Sts., Philadelphia, Pa. Licensed manufacturer for Australia: Tutt Bryant, Ltd., South St., Rydalmere, NSW.

*Pronounced Q Ken — U. S. and Foreign Patents pending.

STRAUB MFG. CO.

510 CHESTNUT STREET — OAKLAND 7, CALIFORNIA

Kue-Ken Balanced Crushers	Rib Cone Ball Mills	Overflow Classifiers
Kue-Ken Simplex Crushers	Concentrating Tables	Feeders
Kue-Ken Gyratory Crushers	Overhead Eccentric Crushers	Screenwheel Classifiers

Kelly's Creek Colliery Company

solves a costly maintenance problem with

J&L HEAT-TREATED JALLOY STEEL

J&L STEEL

Unretouched photographs of the sluices in the McNally-Pittsburg Coal Washer at the Maiden Mine, Maidsville, W. Va. (Above) Sluices filled with fast-moving coal and water. (Right) Water flows over the exposed JALLOY plates.

Sluice-plates formerly replaced monthly . . .
Now heat-treated JALLOY plates last 10 times as long

Slide 300 tons of coal *an hour*—day in and day out—down the steel sluices of a coal washer, and you would *expect* the bottom plates to wear out rapidly. Kelley's Creek Colliery Company* considered monthly replacements quite normal for sluice bottom-plates—until they put in J&L *heat-treated* JALLOY Steel. Now they get 10 times longer service. This means lower maintenance cost . . . higher profits.

But that's not all! Conveyor sides and bottoms of mild steel generally lasted 3 months at the most. A year ago JALLOY plates were installed . . . Present indications are that these plates will be in service at least *another year* before replacement is necessary. That will mean a minimum of *8 times* longer service.

JALLOY is a heat-treated, manganese-molybdenum steel developed by J&L for just such uses as these—for resisting extreme abrasion and heavy shock.

Manufacturers and maintenance men, alike, find that JALLOY heat-treated plate makes equipment last longer. The outstanding wear-resistant properties of this *modern* steel have been proved again and again in such applications as: Bulldozers . . . Scrapers . . . Rock crushers . . . Power-shovel buckets . . . Dump cars . . . Truck bodies . . . and Sand-blast equipment.

If abrasion is a limiting factor in the life of *your* equipment or products, you'll find it profitable to investigate JALLOY. Let us send you the booklet mentioned in the coupon.

Jones & Laughlin Steel Corporation
412 Jones & Laughlin Building
Pittsburgh 30, Pa.

☐ Please send me your booklet: "JALLOY—J&L Alloy Steel."

☐ Do you recommend Jalloy for:

Name .....

Company .....

Address .....

.....

*Subsidiary of The Valley Camp Coal Co., Cleveland, O., producers of "Valley Camp" coal.

JONES & LAUGHLIN STEEL CORPORATION

From its own raw materials, J&L manufactures a full line of carbon steel products, as well as certain products in OTISCOLOY *and* JALLOY *(hi-tensile steels).*

PRINCIPAL PRODUCTS: HOT ROLLED AND COLD FINISHED BARS AND SHAPES • STRUCTURALS AND PLATES • HOT AND COLD ROLLED STRIP AND SHEETS • TUBULAR, WIRE AND TIN MILL PRODUCTS • "PRECISIONBILT" WIRE ROPE • COAL CHEMICALS

A JOB FOR A LONG-TERM SHOVEL

Loading iron ore on the Mesabi Range places extra premium on the 5-yard 120-B's longest suit—ability to deliver a long-term average of high production and economy. Massive strength, minimum weight, high speed cycle, low power consumption, these are some of the features that keep Bucyrus-Eries "years ahead."

For *Sustained* High Production at Low Cost...

BUCYRUS ERIE

SOUTH MILWAUKEE, WIS.

DORRCO DOINGS IN 1948

1948 has been a year of gains and losses. The greatest overall gain, I believe, has been the definite actions which have clarified the world situation and brought a magnificent response at home—a response which indicates that, almost unanimously, we recognize the fact of one world. Truly may it be said that what is the concern of one must be the concern of all.

As to the future, I am reminded of the reply of the elder J. P. Morgan who was asked by a young man whether he knew what the market would do: "Yes," said Mr. Morgan, "it will fluctuate!" I think we can safely conclude that, whatever the trend today, the prospect of "Peace or War" will fluctuate for the next ten years or longer and we shall have to make the best of it. I believe, however, that the swing will be longer and longer toward the side of peace.

* * *

EUROPEAN ASSOCIATES— Many will be interested in knowing we have acquired a new home in Amsterdam—a 300 year old building of one of the old merchant princes. Owing to housing difficulties abroad, we will have rooms there, like the flats we maintain in London, available at times for friends in trouble.

All of the Dorr-Oliver companies in Europe have advanced and prospered in 1948 and gotten over the hump of the production problems which plagued them last year. Outstandingly large accomplishments were the supplying of numerous dewaxing filters for European oil refineries; the furnishing of processing equipment for titanium pigment manufacture in England and India; and the equipping of a number of cement mills in Western Europe.

CLASSIFICATION—The Classifying field for us is expanding with our acquiring the license and selling rights here in America for the Hydro-Cyclone of the Dutch State Mines for general use. It shows good possibilities for special classification conditions. We are also working on a development which should show the value of combined hydraulic and mechanical classification and its effect on grinding and flotation efficiencies.

SUGAR CANE & SUGAR JUICE—At the Waialua and Ewa Factories in Hawaii, the earth-laden water from the operation of cane washing, necessitated by "grab" harvesting, is passed to a Dorr Hydroseparator which yields a satisfactorily clear water for re-use and a thick sludge of soil and water for return to the fields.

To the famous Central Casa Grande in Peru has been delivered a duplicate of the world's largest cane juice clarifier—a 40 foot diameter Multifeed with 5 compartments. The first unit of this size is in operation at Chaparra of the Cuban American Sugar Company.

NON-METALLIC MINERALS—Florida phosphate is highlighted by the first installation of a new, heavy-duty, Dorr Hydroseparator and the installation of a 300 ft. Dorr Thickener in an earthen basin 750 ft. in diameter. The additional area in the latter case will slowly collect small quantities of ultra-fine slime particles which, it is believed, may not have to be removed during the life of the mining operation.

MUNICIPAL SANITATION—A successful, full-scale demonstration of the use of the Dorrco Vacuator ahead of sedimentation at Palo Alto removes the scum problem for plants where the amount of cannery waste does not exceed that of domestic sewage. This invites cooperation between industry and municipal plants. At the Hyperion plant in Los Angeles, our most recent Dorr Digester will be installed in 110 ft. tanks for primary digestion.

Our Biofiltration System of sewage treatment, used so widely during the War, is being adapted for peace-time plants with capacities up to 25 million gallons per day. The latest goes to Cobourg, Ontario.

CEMENT—Much has been done in cement plants the world over, including France, Belgium, and the Argentine. Two of the most modern plants in this country, completed this year, employ complete Dorr C.C.G. Systems, consisting of two stages of closed-circuit grinding, slurry thickening and slurry mixing.

COAL, CHROME & COPPER—The South's first, large, modern coal-cleaning plant, near Birmingham, is to use Dorr Hydroseparators and Thickeners, while a large middle western plant for leaching chrome sinter is to have two of our continuous counter-current systems—one, consisting of four, large three-deck Dorr Washing Classifiers, for the coarser fractions and the other, consisting of five stages of decantation in Dorr Thickeners, for the finer fractions.

The great demand for copper has necessitated new plants and remodeling of old ones, and Dorr equipment has been largely in demand, including Classifiers, Bowl Classifiers, and large Thickeners.

FLUOSOLIDS & CONSULTING ENGINEERING—Two more Dorrco FluoSolids Systems have been placed under contract this year—one, now nearing completion, for a 100 ton a day lime calcination operation and the other for roasting daily 65 tons of arseno-pyrite gold concentrates. Our consulting staff, in addition to FluoSolids design, has worked on many diversified projects—a 2500 ton flotation mill, phosphate fertilizer plants, an alumina plant and magnesia from sea water investigations both here and abroad.

* * *

During the past summer, I combined a visit to our European associates with joining a small group that toured over 5,000 miles in a station wagon, visiting staff, offices and installations in order to obtain material for a colored film—"The Story of The Dorr Company". These visits ranged from Boliden in North Sweden to Venice. The warm cooperation met everywhere and the closer association with our own staff in Europe emphasized the essential unity and good will existing today across the Atlantic.

A three months' trip around the world made by one executive and a five months' trip made by another, covering the countries of Central and South America, together with frequent exchange visits of technical staff, all assist in our vision of "Dorrco World Wide!" This is evidenced by the visits to our offices, and especially "Westport", of technical men from all parts of the world.

To our friends and to Dorr staff and associates we send New Year's Greetings and with them an expression of our strong faith in the future.

John V. Nordberg

570 Lexington Ave., New York 22

DORRCO

FLOW SHEETS
NEED A CHECK-UP, TOO!

Good Metallurgy, like good health, can best be assured by frequent, objective check-ups! And the best time to do it is while you can . . . rather than when you must!

Today's strong metal markets and capacity operations coupled with progress in reagents and processes provide opportunities for higher recovery and better grade from the same or lower-grade feed. Many mills have made substantial progress by challenging time-honored ideas of reagent costs permissible to achieve higher grade, lower tails and more profitable operation.

Some have found that the newer reagents, known to be more efficient but hitherto considered too high-priced, are economical at today's metal and non-metallic prices. Others have found ways to introduce old established Cyanamid reagents into modified flow schemes to wring still greater returns from the ore. Still others have adopted pre-concentration by Heavy-Media Separation as the low-cost way to expand mill output quickly and at low capital-cost.

For example:

AMERICAN Cyanamid COMPANY

EXAMPLE 1 Tailings losses have been lowered and concentrate grade doubled at a large copper concentrator by using .08 lb. per ton of Reagent 404 with .03 lb. per ton of Reagent 301 as promoters, and by regrinding the rougher flotation concentrate. Concentrate grade has been raised from 14.252 to 30.665% and the tailing loss has ben decreased from 0.252 to 0.185%.

EXAMPLE 2 Dilution with alabandite (MnS) caused difficulty in maintaining grade on a lead-zinc ore. Sodium cyanide and potassium permanganate were used to depress the sphalerite while the alabandite was floated with a mixture of pine oil and cresylic acid as a frother, thus raising the grade of zinc concentrate from 45% Zn to 52% Zn.

EXAMPLE 3 Merely by changing to Sodium Aerofloat* "B", a custom-mill treating lead-zinc ores raised the grade of zinc concentrate from 46% to 54% Zn.

EXAMPLE 4 Barite ores containing fluorite proved extremely difficult to treat because of the similar flotability of the two minerals. Cyanamid Mineral Dressing Laboratory found that selectivity could be achieved by using sodium silicate and barium chloride to depress fluor-spar. Barite is floated with Reagent 825. By the use of this reagent combination, 90% of the barite is recovered in a 98.5% $BaSO_4$ concentrate containing 0.096 CaF_2 from an ore assaying 84% $BaSO_4$ and 7% CaF_2. Tailing contained 45% CaF_2.

EXAMPLE 5 A large flotation plant treating a manganese ore (rhodochrosite) found that substitution of Reagent 825 for one-half of the fatty acid soap, reduced total promoter consumption by one-third. The type of froth produced by the new promoter combination results in smoother and more uniform plant operation. Lower tails are obtained with a decrease in reagent cost—a double dividend!

EXAMPLE 6 When the pyrite in the mill feed increased, a lead-zinc flotation plant in the Western U. S. began to have trouble with zinc concentrate grade. All of the well-known zinc promoters were tried. Finally Aerofloat* Flotation Reagent 226 was put on the mill. Only 0.06 pounds per ton in the form of a 10% solution added to the third conditioning, after the lime and copper sulfate, has produced acceptable grade.

EXAMPLE 7 Having trouble with lime scale in your solution lines? Experiencing lime deposition on the filter cloths in your cyanide plant? The Cyanamid Mineral Dressing Laboratory finds that complex phosphates, such as sodium tetraphosphate ($Na_6P_4O_{13}$) act as "sequestering agents" preventing lime deposition, thus greatly increasing the life of filter cloth. A surprisingly small amount is effective . . . as little as 10 pounds per day per 2,000 tons of solution . . . 0.005 pounds per ton!

EXAMPLE 8 In Heavy-Media Separation (Sink-Float) Processes, magnetic medium has been found superior to all others. Two large Heavy-Media plants which formerly used galena have now converted to ferrosilicon with better grade of concentrate and lower tails. A third plant will convert in 1949. Ferrosilicon is considerably cheaper than galena. It is also easier and cheaper to clean and keep clean, thus making it possible to operate at higher gravities when necessary. One plant treating barite ore operates at 3.75 specific gravity! Slimy ores present no problem. One Heavy-Media Separation operator writes "Chief virtue of ferrosilicon is in the ease of cleaning. Some of the muddy ore now being received at our mill would be extremely difficult to handle with galena as a medium."

*Aerofloat is a registered trademark of American Cyanamid Co. applied to certain flotation reagents of its manufacture.

★ ★ ★ ★

In your check-up of milling and treatment methods, Cyanamid Field Engineers and the Cyanamid Mineral Dressing Laboratory stand ready to help you make the most efficient use of chemical reagents and Separation Processes by Gravity Difference. An unbiased review of your present beneficiation practice may reveal worthwhile opportunities to increase recovery, cut costs or expand output. Starting point is a discussion of your current metallurgy and ultimate objectives. We invite correspondence.

Part of Cyanamid Service to Metallurgy is MINERAL DRESSING NOTES, a publication of the Cyanamid Mineral Dressing Laboratory issued whenever new technical data on reagents and processes becomes available. If you would like to receive these helpful bulletins, kindly fill out the coupon below.

Name _____

Company _____

Address _____

_____

30 ROCKEFELLER PLAZA,
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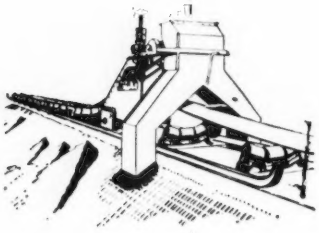
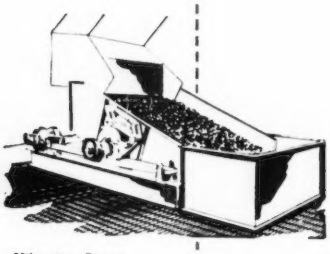
Is "Materials Handling" a Profit Thief in Your Operation?



Belt Conveyor Tripper

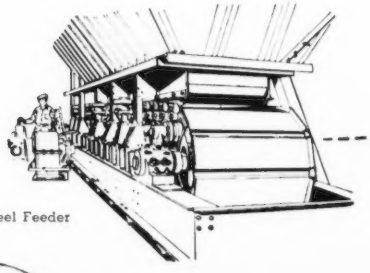
Bulk materials handling systems built years ago for a particular set of conditions may be "getting by" under new conditions and products.

Perhaps many of today's production difficulties can be traced to plant layout, cost accounting, or peculiarities of your particular operation. But, remember, it is *often* materials handling.



Vibrating Screen

Let us make a pretty responsible statement: *In about 8 out of 10 operations, some saving can be made by reviewing the handling of bulk materials.* Stephens-Adamson engineers are available to assist. They represent a staff thoroughly experienced in applying every type of conveyor, elevator, and hoist from the *complete* S-A Line to every type of bulk material and plant layout. Let us talk this over with you — say so in any convenient way — phone, wire or letter.



Manganese Steel Feeder

STEPHENS-ADAMSON MFG. CO.

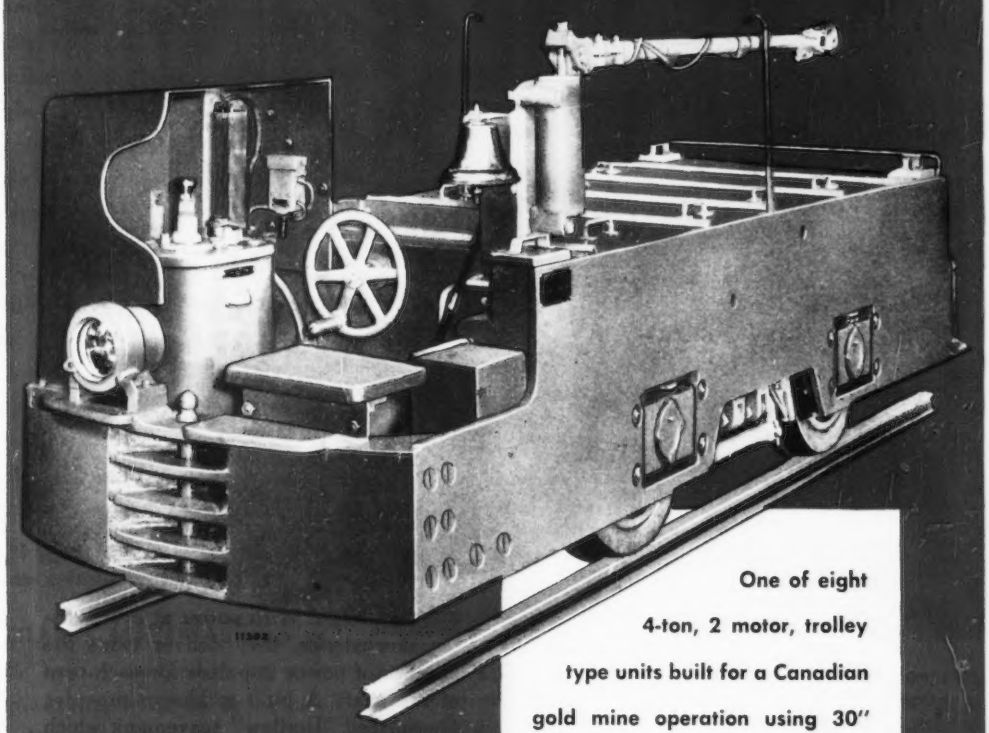
4 RIDGEWAY AVENUE, AURORA, ILLINOIS ★ LOS ANGELES, CALIF. ★ BELLEVILLE, ONT.

Designers and Manufacturers of All Types of

BULK MATERIAL HANDLING EQUIPMENT

If it's **UNDERGROUND LOCOMOTIVES** *you need*

...SEE GOODMAN



GOODMAN BUILDS A COMPLETE LINE OF TROLLEY, STORAGE BATTERY OR COMBINATION TYPE LOCOMOTIVES FOR ANY CONDITION OF SERVICE IN METAL MINES, COAL MINES AND TUNNELS.

One of eight 4-ton, 2 motor, trolley type units built for a Canadian gold mine operation using 30" gauge track. Construction provides full protection of controller and motors from water and muck.

Smooth side plates with no protruding bolt or rivet heads promote safety.

GOODMAN MANUFACTURING COMPANY

HALSTED STREET AT 48TH • CHICAGO 9, ILLINOIS

In England — UNITED STEEL COMPANIES, LTD.

"No Loss of POWER at HIGH ALTITUDE"

THAT'S what drivers for The McLaren Gold Mines Co., Cooke, Montana say of the General Motors Diesels powering their Euclid dump trucks. And they're speaking from really rugged experience.

The mine is at an altitude of 9600 feet. On a haul of 4½ miles over grades as steep as 16%—these trucks make 8 round trips per 9-hour shift. They work without a whimper—18 hours a day, 7 days a week.

GM Diesels are especially well suited to high-altitude operation because of their 2-cycle design. With power at every piston downstroke, they deliver twice the number of power impulses for each turn of the shaft. A built-in blower provides pressurized "Uniflow" scavenging which assures cleaner, more complete combustion. This gives them plenty of tough, fast-stepping horsepower that's quick to respond to a touch of the throttle.

No matter what your requirements may be, if you want sturdy, money-making power, be sure to look into General Motors Series 71 Diesel engines.

DETROIT DIESEL ENGINE DIVISION

SINGLE ENGINES . Up to 200 H.P. **DETROIT 28, MICHIGAN** MULTIPLE UNITS . Up to 800 H.P.

GENERAL MOTORS

DIESEL BRAWN WITHOUT THE BULK

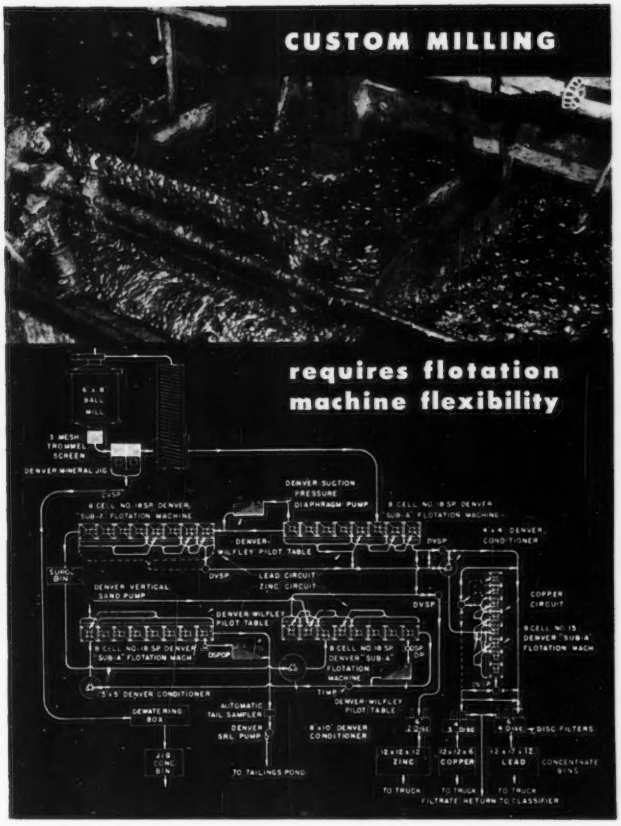
GM GENERAL MOTORS DIESEL POWER

Using Denver "Sub-A" Flotation Machines

. . . The American Zinc, Lead and Smelting Company at Ouray, Colorado, serving mines of the San Juan Triangle, are able to economically treat a wide range of complex ores in this 225-ton-per-day Denver Built Custom Mill.

FLOTATION FLEXIBILITY is the key to successful recovery of the many minerals treated. Any Denver "Sub-A" Flotation Cell, singly or in a bank, may be used as a rougher, cleaner, re-cleaner, or even as a conditioner, giving selective high-grade concentrate with low tailing.

COARSE MATERIAL (up to ¼") may be fed from any quadrant, with no short circuiting of pulp. Accurate pulp level is easily maintained. Middlings are recirculated by gravity without use of pumps. Air and/or gas can be admitted under positive control to any Denver "Sub-A" Flotation cell.



PRINCIPAL ORE MINERALS, recovered at this American Zinc Custom Mill by Denver "Sub-A" Flotation, cover a wide range and may vary considerably from hour to hour. These include:

GALENA	GRAY COPPER (copper, arsenic and antimony sulfides usually containing silver).
SPHALERITE	
CHALCOPYRITE	
MARMATITE (ZnFeS)	GOLD AND SILVER BEARING PYRITES.
ENARGITE (Cu_3AsS_4)	COMPLEX BASE METAL SULFIDES.

You may read the complete story of this custom milling operation in Deco Bulletin M4-B51. Write for your free copy.

"The firm that makes its friends happier, healthier and wealthier"

DENVER EQUIPMENT COMPANY
P. O. BOX 5268 • DENVER 17, COLORADO

DENVER • NEW YORK CITY • CHICAGO • TORONTO • VANCOUVER • MEXICO CITY • LONDON • JOHANNESBURG • RICHMOND, AUSTRALIA

Any V-BELT Changes Shape *when it Bends*

Prove this yourself!

That's Why the CONCAVE SIDE

(U. S. PATENT NO. 1813698)

Gives You 2 Big SAVINGS!

Bend *any* V-Belt and *f e e l* it change shape. The top, under tension, *narrows*. The body, under compression, *widens*. The sides of the belt bulge out.

Straight-Sided V-Belt

Straight-Sided V-Belt Bulges in Sheave-Groove.

The result, if the belt is built with *straight* sides, is a shape that does not fit the sheave groove — as shown in Figures 1 and 1-A, above.

Now, bend the V-Belt built with the precisely engineered Concave Side (U. S. Patent No. 1813698) — the Gates Vulco Rope.

Gates Vulco Rope With Concave Side.

No Side Bulge. Precise Fit in Sheave Groove.

You get the same shape change but *now* the new shape *exactly fits* the sheave groove as shown in Figures 2 and 2-A.

Results— (1) *Uniform* side-wall wear; *longer* life. (2) *Full* side-wall grip on the pulley; carries heavier loads and sudden load increases without slippage — a big increase in drive efficiency—saving belt wear a n d also saving power!

REG. U. S. PAT. OFF.

The Mark of ***SPECIALIZED*** *Research*

The Concave Side is MORE IMPORTANT NOW Than Ever Before

Because the *sides* of a V-Belt are what actually *drive* the pulley, it is clear that any increased load on the belt means a heavier load that must be transmitted to the pulley *directly* through the belt's side-walls.

Now that Gates *SPECIALIZED* Research has m a d e available to you SUPER Vulco Ropes—carrying fully 40% higher horsepower ratings—the life-prolonging Concave Side naturally delivers greater savings today than ever before.

4812

GATES VULCO ROPE DRIVES

Engineering Offices and Jobber Stocks IN ALL INDUSTRIAL CENTERS of the U. S. and 71 Foreign Countries

THE GATES RUBBER COMPANY
DENVER, U.S.A.
"The World's Largest Makers of V-Belts"

THE BEGINNING OF A LASTING FRIENDSHIP

Nothing makes a bigger hit with runners than equipment that combines easier handling with fast, positive action. Make sure they get it — and they'll cut costs for you on every shift!

Take this new Blue Brute Stoper, for example — the self-rotating WR-31. Note how the holding handle is placed *above* the center of gravity, for better balance. Then, there's the shielded, down-directed exhaust . . . and the constant air stream that keeps sludge and water out of the shielded chuck . . . additional features that get a runner's enthusiastic OK!

Built throughout for continuous heavy duty, the WR-31 is packed with design improvements. Like the ratcheted rifle bar's engagement of four air-operated pawls on the piston's backstroke . . . a typical Worthington "exclusive" for fast, trouble-free drilling.

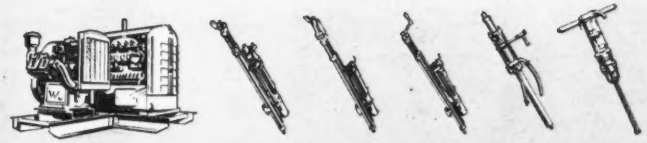
Let an on-the-job demonstration prove to you that *there's more worth in a Blue Brute.* Get your runners' verdict on the WR-31's ease of handling . . . and see for yourself how much cleaner and faster they can cut away footage.

Write for literature describing the complete line of BLUE BRUTE Mining Equipment, including Drifters, Stopers and Hand-Held Drills. HE.19

BLUE BRUTE DRIFTERS

Types WPM (Pneu-Motor incorporated in Drifter), WPMS (Pneu-Motor on Shell), and WHC (Hand Crank). Featuring the new, *balanced* design for faster drilling cycles and all-around operating economy.

BUY BLUE BRUTES



Semi-Portable Compressors. Drifters with Feed Motor Incorporated. Drifters with Feed Motor on Shell. Hand-Crank Drifters. Stopers. Hand-Held Rock Drills.

WORTHINGTON

Worthington Pump and Machinery Corporation, Worthington-Ransome Construction Equipment Division, Holyoke, Mass.
Distributors in all principal cities

The **ROCKMASTER** Blasting System Holds Down Costs In Spite of Rising Expenses!

In quarries, mines, stripping operations, and on construction projects the cost of drilling, labor, and supplies has increased—but *over-all* costs have been knocked down through the use of the ROCKMASTER Blasting System!

By switching to ROCKMASTER, one limestone quarry effected a reduction of more than 50% in drilling and dynamite costs! Now, instead of drilling on 4-foot centers, holes are spaced on 8-foot centers—sometimes even greater. Breakage is exceptionally good . . . objectionable noise and vibration has been cut to a minimum. This is not an isolated case! More and more users of explosives are using ROCKMASTER to get better breakage . . . save wear and tear on equipment . . . cut *over-all* costs.

When Atlas pioneered ROCKMASTER, it introduced a new concept of blasting. ROCKMASTER is a blasting *system* based on the right explosive and method of loading . . . the proper spacing of holes . . . the selection of the right millisecond delays—all based on the kind of rock being blasted.

Call in your Atlas representative. He'll be glad to show you how the ROCKMASTER Blasting System can be adapted to *your* job.

ROCKMASTER GIVES YOU THE GREATER SAFETY OF MANASITE DETONATORS

Less Bark . . . More Bite

"ROCKMASTER"—Trade Mark
Manasite: Reg. U. S. Pat. Off.

ATLAS EXPLOSIVES *"Everything for Blasting"*

CHEMICALS ATLAS EXPLOSIVES

ATLAS POWDER COMPANY, Wilmington 99, Del. • *Offices in principal cities* • *Cable Address—Atpowco*

No More "Dry Runs"

New Gardner-Denver
Automatic Line Oiler
Safeguards Rock Drill Lubrication

Here's positive protection against running rock drills without adequate lubrication. When all the oil in the new Gardner-Denver L012 Automatic Line Oiler has been used, air in the line automatically shuts off. Consequently, *there is absolutely no chance for drills to run when dry.* A carefully metered flow of atomized oil assures smoother lubrication with lower oil consumption—increases the operating efficiency of all air actuated equipment. Here are other valuable L012 features:

OPERATES IN ANY POSITION — L012 Line Oiler operates equally well in any position, either vertically or horizontally.

USED WITH A WIDE RANGE OF TOOLS — L012 will lubricate any pneumatic equipment using from 25 to 500 cubic feet of air per minute.

EASY TO REFILL — it is not necessary to shut off live air in order to refill the L012 Line Oiler.

For complete information, write Gardner-Denver Company, Quincy, Illinois

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Worn Sheaves are on his blacklist

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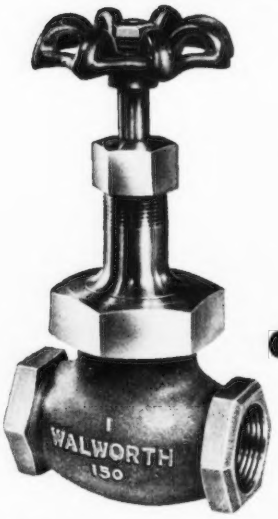

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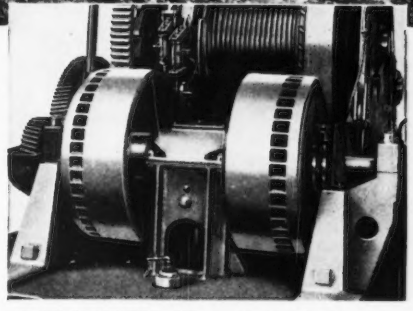

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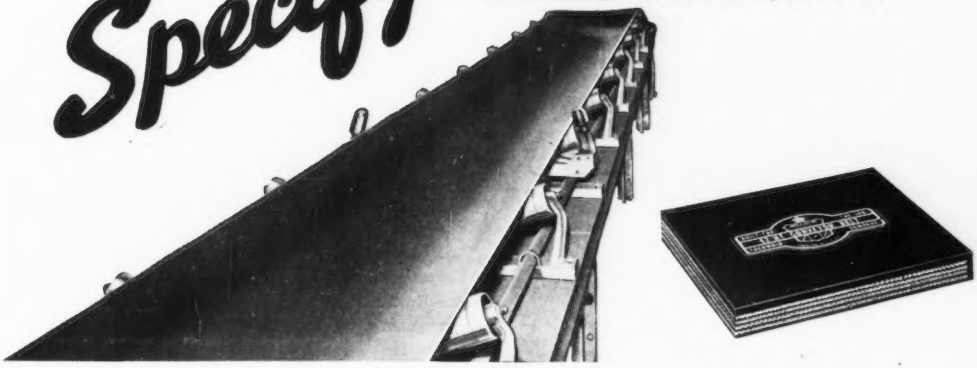

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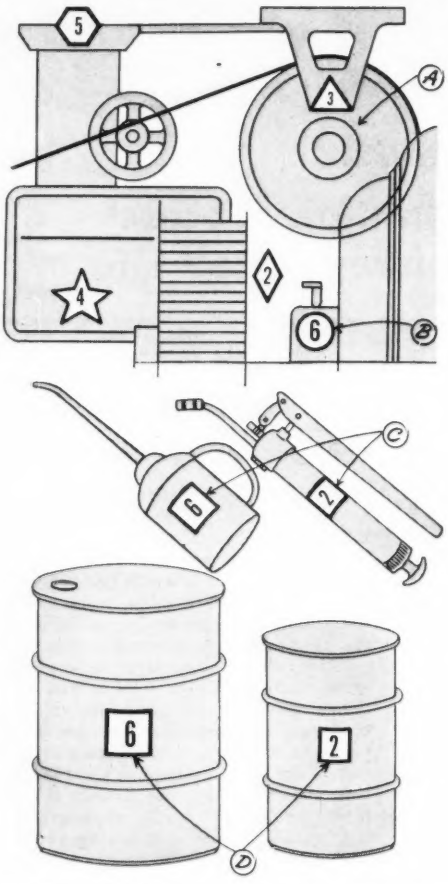
STANDARD ENGINEER'S CASE FILE

Case 1102--Preventing Lubrication Mistakes in Plants and Motor Fleets



Many operators of plants and fleets in the West have practically eliminated operation delays due to improper lubrication or use of wrong lubricants, by installing Standard of California's free, coded system of planned lubrication. The system employs symbols instead of colors to indicate lubrication intervals -- stops mistakes caused by color-blindness, faded colors or changed appearance of color in different lights. Available for plants and fleets in the Seven Western States.

A. Black-on-white decalc symbols show desired lubrication intervals at a glance. Are placed directly on machine at lubrication points.

B. Numbers on the decalcs indicate the kind and grade lubricant to be used at each point. Chart card on each machine gives meanings of symbols and numbers.

C. Lubricant number-decalcs on dispensers identify lubricant in each dispenser and prevent its use in wrong place.

D. Lubricant number-decalcs on barrels, cans or other storage show kinds and grades of lubricant in stock.

All decalcs, chart cards and other material for the Standard Coded System of planned lubrication, and installation of the system are free. On request, a Standard Fuel and Lubricant Engineer from Standard Technical Service will survey your plant or other operation any place in the Seven Western States. He will make recommendations, give expert advice and install the Standard Coded System if you desire it.

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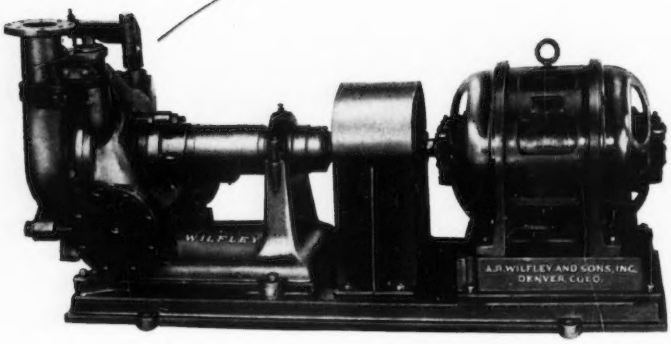

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What Are *YOUR* Chances If There Are No Profits?

Since the November 2 election there has been a dazzling variety of plans to have the government do more and more things and spend more and more money. But there is almost no variety in the plans which are suggested to raise the money.

"Pay for it by taxing profits," is the standard refrain. Slap on an "excess" profits tax. Boost the corporations' income tax rate.

Well — why not? Haven't the corporations been making so much money that a big chunk of it can be turned over to the government spenders without hurting anybody?

The answer is no!

How high profits should be can be debated endlessly. Some people claim that 1948 corporation profits, which will amount to about $20 billion, are too high. They emphasize the fact that profits are larger in relation to investment than they were a few years ago. Other people think profits are low. They stress the fact that profits are not much larger in relation to sales than they have been historically. Both sides agree that in some individual cases profits have been too high, as in others they have been too low or non-existent.

But if we cut the total volume of profits drastically, we shall do so at our national peril.

There is no room for debate about that. For we shall choke off the crucially important job of building new plants and equipment for our industries. Squeeze hard enough, and America will go the way of Britain — down the long and painful skids of industrial decline. Widespread unemployment, especially among our industrial workers who produce new plants and equipment, will mark the dreary way. Here is a fact which the President, the Congress, the C.I.O., and all of us have a real reason to remember:

Almost two-thirds of all profits today are going to rebuild and improve plants and equipment.

More than $13 billion of this year's profits are being plowed back. They are going — as a large proportion of profits have always gone — to buy for workers better tools to work with, better surroundings in which to work. They are making possible better products, and more of them, for all of us.

The figures below show how companies have put more and more profit-dollars and a larger share of their profits to work in the business:

YEAR	PROFITS REINVESTED	% OF TOTAL PROFITS
1929	$2.6 billion	31%
1939	1.2 "	24%
1943	5.9 "	57%
1944	5.2 "	53%
1945	4.2 "	47%
1946	6.9 "	55%
1947	11.2 "	62%
1948 est.	13.0 "	65%

continued on next page

The record shows that each of us is the real beneficiary of this plowing back of profits.

Every American has benefited from these profits. Each dollar that business has put into its plants and equipment in the last thirty years has increased our yearly production by 35 cents.

This re-investment of profits has helped make possible a 75% increase in living standards since 1919.

It has helped increase wages from an average 48 cents an hour in 1919 to $1.36 today. Allowing for higher prices, that increase means that an hour's work today will buy twice as much as it did thirty years ago.

Why must business retain these billions of profits to improve its plants and equipment? Why must it plow back more and more? *The reason is that business already is caught in a tax squeeze.*

Federal taxes alone take at least thirty-eight of each one hundred dollars a company earns. Then, if the company pays out to its stockholders any part of what is left as dividends, the federal personal income taxes of the stockholders may take up to 77% of those dividends. Under these conditions, so few people are willing to invest in industry that the stock market is stagnant. Companies can not raise in that market the money they need for improvements.

The result: business must rely more and more on plowed-back profits to pay for new plants and equipment.

We know that everywhere in industry new and better ways of producing goods are standing ready for use. The previous editorial in this series mentioned some of them. We know, too, that depression and war put our industries far behind schedule – as much as $100 billion behind – in getting the new tools they should have had to keep themselves in first-class shape. McGraw-Hill is now completing a survey of industry that will measure these needs. The results will be published in this editorial series. We know already that in 1949 alone industry will need $18 billion or more for this purpose.

And all but a small fraction of that sum must come from profits.

Our prosperity, our strength as a nation, our hopes for better living depend on our continuing to generate and to plow back a large volume of profits.

For that reason we should not thoughtlessly follow these people who propose to pay for any and all new government activities by saying simply, "Soak the corporations." There is no need to follow them. There are other ways of obtaining necessary funds.

First and foremost should be economy within the government itself. If its citizens must pay still higher taxes, then surely government should exercise rigid self-restraint, cutting out all but the most essential activities and expenses.

After economy should come consideration of a broader federal tax base.

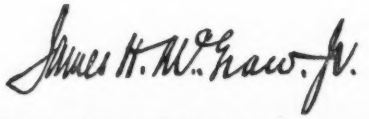
If these and other methods of raising money are inadequate and if taxes must take a bigger bite from business profits, two facts are clear. We should not adopt an "excess" profits tax with all of its complications and all of its corrupting effect on business. A moderate increase in the regular income tax on corporations is much less dangerous. *But even such an increase, if necessary, should be accompanied by special allowances for expansion and depreciation that will encourage companies to continue spending their earnings for new plant and equipment.* We all have a stake in that.

At this critical juncture in our history profits have a new and vastly more important role than they have ever had. In unprecedented degree they are the drive behind our present prosperity and the key to a better, stronger future.

Give profits the axe and the blow does not stop there.

It cuts into the employment, the prosperity and the strength of our nation.

Everyone of us has a stake in how the President and Congress handle taxes on profits – and now is the time to remind them of that stake.



President, McGraw-Hill Publishing Company, Inc.

ENGINEERING AND MINING JOURNAL

JANUARY, 1949

Clear The Confusion on Stockpiling

PROBABLY NO PROGRAM of direct concern to the metal mining industry currently produces more confusion on its objectives than the matter of Government stockpiling of non-ferrous metals. Stockpiles are regarded by some as a means of furthering military security; by others, they are regarded as a threat, or an aid, to the mining industry, depending on the point of view.

Some think the stockpile program is lagging dangerously; others believe there should be no stockpile program at all, except for certain vital materials which the United States simply does not possess.

Under these circumstances, this nation is drifting into stockpile programs and policies that are improvised to suit the needs of the moment. Long-range objectives are not taken into account. In its own interest, as well as the nation's, the metal mining industry ought to clarify its own attitude on stockpiling, so that it may work actively toward a desired objective, whatever it may be. To begin with, what elements of certainty may one discern in the stockpile picture?

First of all, it is clear that debate is useless on the question of whether or not we should stockpile. We *are* stockpiling, and the only questions left to answer are:

1. How fast should we build up stockpiles?
2. How far shall we go with the program?

The first of these two questions is pretty well answered. If nothing happens to disturb the present delicate balance, the producers of copper, lead and zinc can squeeze through until next June. The stockpiles should then be up to quotas, and the domestic demand ought to be easing up a little. To build up stockpiles at faster than present rates would probably end in price control and Government allocation.

In answering the second question, one faces a choice. The present stockpile goals are based on the requirements of military security, nothing more. The program calls for a buying life of five years. At the end of that time, we can drop stockpiling, feeling that security demands have been met, or we can expand the stockpile philosophy into something far larger than it is at present. For the sake of clearing up our thinking on it, let us examine what this larger view of stockpiling would involve.

To begin with, what reasons, other than military, are there for building up stockpiles of non-ferrous metals? For one thing, an expanded stockpile program would protect domestic producers against a possible excessive flow of metals into this country as a result of the efforts of the ECA to increase metal production abroad. In writing the Economic Cooperation Act, Congress certainly had at least partial objectives beyond immediate needs, because it used the phrase "materials in which the United States is deficient or potentially deficient" in setting up responsibilities for the ECA. Congress also provided for long-term agreements to deliver such materials to the United States.

In case these objectives are fulfilled after military stockpile goals are reached, there certainly should be some protection set up for the domestic economy to prevent such flows of material from being dumped into domestic markets.

To expand production so that agreed-upon fractions of the increased output can be delivered to the United States would be impossible as a short-term program. In most instances, about two years are needed to get a new property into production, and at least ten years would be required to amortize necessary investments. Yet our stockpiling program presumably will end in five years. Both to get needed production now, and to guarantee a place for it in the future, a long-term stockpiling program seems indicated.

Next, considering the domestic industry alone, a stockpiling program on the grand scale would produce some interesting results in the way of resource conservation. Mining men are thoroughly familiar with the anti-conservational effects of the intermittent operation of mines caused by fluctuations of the business cycle. A stockpiling authority that would prevent shutdowns in periods of hardship would certainly promote maximum utilization of resources as well as employment stability.

Among other reasons for a permanent stockpile that might be cited is the aid such a program

would give to mine exploration and development, both here and abroad. The industrial economy of the United States is based wholly on a continuing flow of metals. A really large-scale stockpile program would cushion the industrial structure against future depletion of essential supplies of metals.

If an authority be set up to build large stockpiles for eventual economic use, it will be necessary to think in larger financial terms than have yet been considered. The largest appropriation yet made for stockpiling in one year is $600 million. A large-scale, long-term stockpiling program might call for a much greater expense. This sum might be regarded as an investment, the only appropriation items being administrative expense, handling and storage costs, and a margin to cover risk. However, not everyone would share this view.

Obviously, one must make up his mind that although this be magnificent, it is not free enterprise. An accumulation of metal of such size in Government hands would give it potential control over the industry. It would of course be necessary to set up the strongest possible legislative safe-guards against capricious or sudden liquidation of these stocks; but there is no law of that kind that cannot be upset by some future twist in Congressional thinking.

That is the stockpile problem that appears over the horizon. It is not too early for the mining industry to begin thinking about the pros and cons of stockpiling on the grand scale. Certainly each industry member should have a long clear look at the matter so that he will have no illusions about what he is getting into. Then when the time comes for action, the industry can provide the kind of informed and unified leadership that should guide the writing of whatever long-range legislation seems best.

Telling Young Men About Mining

YOUNG MEN ARE NEEDED in the metal mining industry. There seems to be general agreement among mining men on that point. Young men are needed not only in the technical and engineering side of the game, but even more in the practical mining side. The industry needs men to start in at the bottom, so to speak, and learn mining by doing it.

The industry, in general, is fairly well prepared in the way of adequate training programs to take care of new men. Montreal Mining Co., Anaconda Copper Mining Co., U. S. Smelting, Refining and Mining Co., are in this category, to name only a few. The problem is to get the right sort of young men, serious self-reliant workers, to take advantage of these programs.

One way to do it would be to publish information on the mining industry and make it available to young men in a way that would interest and attract them. This could be supplemented by talks to young men's groups by mining executives, and by organized visits of these groups to active mining properties. Probably the latter would be found to be the most effective.

We know that young men are avid for such information, because our own experience shows it. Back in 1945, we prepared and published a pamphlet, which appeared in the magazine as an article, called "Take A Look At Mining, Ex-Serviceman." It was intended to give G.I.'s coming out of the services a chance to find out something about the mining industry as a career. Response to this pamphlet was extraordinary, and copies of it are still snatched up whenever it is made available, for example, to high school students at vocational guidance meetings, even though the G.I. aspect of it has lost meaning.

We should like to suggest to the AIME that preparation of a similar pamphlet, brought up to date, and done on a somewhat larger scale, would be an excellent project for the Institute. The late Dr. T. T. Read did such a job some years ago, and wrote it well. Our experience has been, however, that the idea will be expressed much more effectively with photographs. Pictures, good ones and lots of them, should be used in preparing the pamphlet, and the style of writing should be lively and to the point. As a part of a cooperative effort to get young men into the industry, such a project could be of real service.

The Risks Of Mining

WHEN THE QUESTION comes up before a Congressional tax committee of realistic treatment of mining because of the extra risks involved, no better example could be chosen to prove the point than the experience with the Fad shaft at Eureka, Nevada.

When work started in 1947 to develop a lead-zinc orebody through the Fad shaft, it was esti-

mated that about $1,500,000 would be needed to reach the ore. A cross-cut at 2,250 ft. broke into a heavy flow of water early in 1948, and under an inrush that reached an estimated 3,500 g.p.m., the lower workings had to be abandoned.

New equipment was purchased and in May, 1948, the campaign to pump out the mine began. Capacity provided could handle about 7,500 g.p.m., and the water level was lowered steadily. There seemed to be good prospects for at last getting at the ore. However, instead of the original investment, it soon became clear that about $4,500,000 would have to be spent before production began.

Late in November, catastrophe occurred once more. Again a heavy flow of water broke into the workings, this time flooding out even the mine's 7,500-g.p.m. pumping capacity. Steadily the water rose in the shaft until the workings were again drowned out. At their full capacity, the remaining pumps could only hold the water in check. They could not gain an inch.

On December 10, the company announced in Toronto, that pumping had ceased. The estimate was made that it would take about $8,000,000 to unwater the shaft, provide adequate safeguards against any further floods, and get at the long-sought orebody.

That's what is meant by the risks of mining. No one could have foreseen handicaps so staggering. If every mine had to equip itself in advance with a 15,000-g.p.m. pumping capacity, few mines would ever be developed. The Fad shaft is an extreme case of hard luck, of course, but it is a fact that few mines have been developed without unexpected reverses of some sort that brought costs above the original estimates.

The tantalizing thing about the Fad shaft's bad luck is the richness of the potential prize. Gross value of the orebody's lead and zinc has been estimated at $175,000,000. Net smelter return might run about half that.

Investing in new mine development involves greater risks than other forms of investment, and the rewards should be correspondingly greater. Certainly mine exploration and development must keep on in this country, which means that investment in it must be encouraged. The experience at the Fad shaft, discouraging as it may seem, offers the industry a good example to use in explaining why and how that encouragement must be given.

Gold Still Is A Magnet

PEOPLE DON'T USUALLY WRITE to an editor unless he misspells their names or unless he says something about gold. Shortly after we published an editorial, "The Gold Pot Boils" (Nov., 1948), we began getting letters and telephone calls from people who wanted to buy gold in its natural state and people who wanted to sell it. If we had had the facilities, we could have opened a brokerage office, on a modest scale, then and there.

As it is, we noted late in November discreet advertisements in the daily press to the effect that certain downtown brokerage houses were prepared to give their clients complete information about the purchase of gold in its natural state. There is no question but that interest in acquiring gold, and holding it, is widespread and intense.

Elsewhere, we have noted that the *New York Times* ran a small feature story on the reopening of the goldfields in New Guinea, and was promptly deluged by a flood of inquiries on how one goes to New Guinea and what one needs to mine gold after he gets there.

Also, Mr. W. A. Horrocks, commercial secretary to the South African legation, Washington, said recently in New York that South Africans hoped strongly to build up their dollar supplies in three ways: (1) by increased exports; (2) by increased capital investments; (3) by "possible revaluation of gold, which has not risen in price in line with other commodities."

As Ernest N. Patty said at the meeting of the Northwest Mining Association, "All nations are desperately in need of gold with which to purchase our goods. A tremendous pressure is developing to increase the price of gold so that an ounce of gold will buy more of our goods." He then added, "The Treasury has good reasons for not wanting the price of gold to be increased at the present time." Aside from the inflationary effect of such increase at home, the men who control international finance believe an increase now, or a free market for gold, would spread financial chaos.

Mr. Patty suggested giving the gold miner the option of taking back all his production in the form of small bars that he could sell or keep. The gold miner does that now with gold "in the natural state." What would happen if he could do that with all his production, we are not prepared to say. We do not believe anyone can predict with complete assurance what would happen, simply because there are too many complex forces that would be set loose. We do believe that the pressure of which Mr. Patty spoke, and which we noted in our November issue, will sooner or later result in action.

FRESH SAND-SLIME FILL is solid enough to permit the operator Raymond Coulter to stand on it. The fill is discharging from the pipeline at the right. In the background, two miners are just completing a cribbed raise that comes up through the fill.

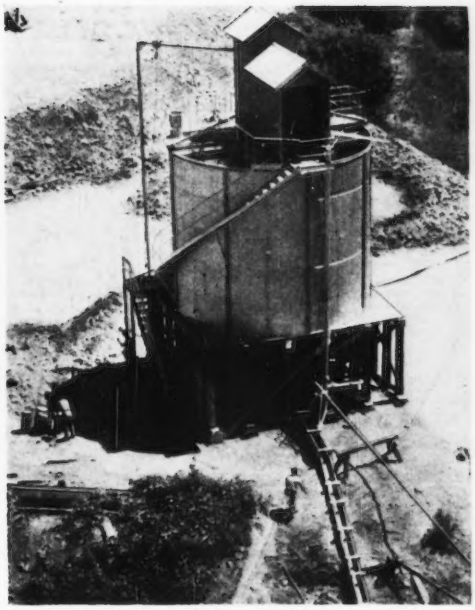
Sand-Slime Stope Filling

Many advantages accrue from practice adopted in Idaho Maryland's New Brunswick mine, reopened after wartime shutdown.

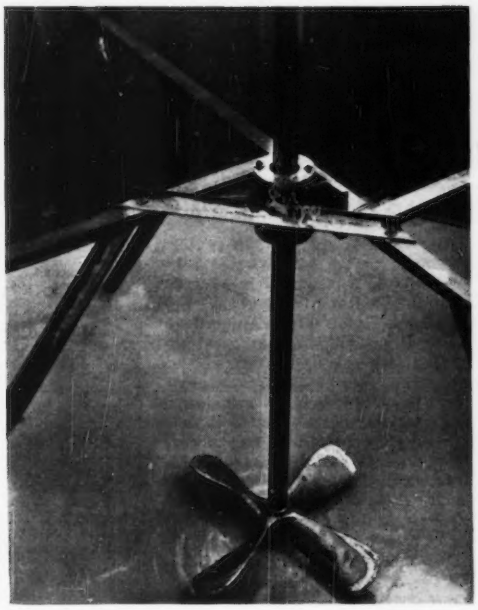
RICHARD KREBS and J. C. O'DONNELL
Mill Superintendent Mine Superintendent
Idaho Maryland Mines Corporation
Grass Valley, Calif.

TAILINGS FILL close to back of old timbered stope. In foreground is timbered raise. Stretching away from camera is pipeline that conveys the sand-slime fill.

MANY PROBLEMS involved in the recapture of workings confronted the Idaho Maryland Mines Corporation on reopening the properties which had been closed by Limitation Order L-208 during the war. One large area which had been partially mined was badly caved. Finger raises had been driven into the hard hanging wall for fill, but as the rate of extraction had been so much faster than that of filling, it was impossible to maintain a cycle of cut-and-fill, and large open areas had resulted. Where square-set timber had been used, the ravages of rot had destroyed it and large areas had caved. Postwar costs made the use of timber impractical. Use of waste rock for fill was also impractical in most instances as the rock would not slide in the flat stopes, and would have to be banked by hand with a high cost for labor. Waste would also have to be mined, at present high costs, to supply a sufficient quantity. Pillars in such a badly caved area could be mined only by using a compact fill that would support the walls during their removal.



AGITATOR TANK permits constant flow of sand-slime mill tailing into mine at a desired density at any volume required.



IMPELLER, with hard-surfaced blade tips and submerged bearing, prevents settling in agitator tank. Note the cross bracing.

Proves Satisfactory

The cost of rock fill and its undesirable features led to the investigation of the possibility of using mill tailings as a source of fill material. This has a practical application in mining orebodies where walls or backs are weak, also where stringer zones occur that make the opening of too much ground costly and unsafe. Tailings can be brought to within 8 ft. of the back for stoper drilling or, if backs are bad, they can be brought up against the ground and the ore can be breasted down with a drifter.

A supply of 600 tons of tailings per day on the average was available at the New Brunswick mill. This plant produced a flotation tailing containing approximately 1% plus-28-mesh and 30 to 35% minus-200-mesh. In terms of average flotation tailings this is relatively coarse. We believed that the coarse particles would not be harmful if sufficient slime material remained in the pulp to act as a bond with the sand particles, which would produce a compact fill that would stand unsupported after a short period. Clean sand, even after long periods of standing, would "run" after the supporting walls were removed. The slime content also increases the viscosity of the pulp, which reduces the velocity and consequently the wear in the pipelines. We found our reasoning correct on both points and therefore call this type of filling material "sand-slime," to distinguish it from straight sand filling. The term slime is used throughout this article to designate the minus-200-mesh fraction.

Reports on other operations and the results of our pilot plant indicated that many difficulties met underground could be eliminated if the tailings were prepared properly before being discharged underground. This phase of the operation was given prime consideration, to develop a technique that might eliminate some of the difficulties experienced with former practices. We believe we have largely succeeded in doing so, and would like to present data on our operation.

Several papers have been written about sand-filling of stopes, two of which were available to us at the time we were considering the method of filling. These described the operation at the Homestake mine[1] at Lead, S. D., and the Sliger mine,[2] near Georgetown, Calif.

A brief outline of several methods considered, employing various types of equipment, will be given to illustrate our line of reasoning, and to clarify certain points that we considered in making a final decision in the choice of methods to be used.

1. Continuous Dewatering Devices: Classifiers, dewatering cones, and related equipment all have the disadvantage of being limited in the rate of flow by the tonnage capacity of the mill. Unless the mill tonnage is equal to the supply required to keep the pipeline full, it would be necessary to restrict the flow at the end of the line by valves or reduction orifices, which are very unsatisfactory. Also a variation of pressure, and consequently a variation of capacity, would result from dis-

[1]By Alex Ross, formerly general superintendent of the Homestake mine. Presented at an A.I.M.E. meeting in June, 1939.

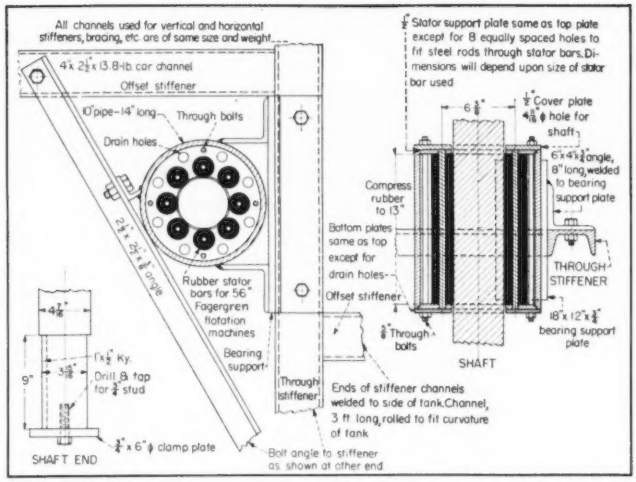
[2]"Filling Mine Stopes with Mill Tailings." By C. W. Plumb, general manager, Middle Fork Gold Mining Co., Sacramento, Calif. Presented at Annual Metal Mining Convention, Western Division, The American Mining Congress, San Francisco, Calif., Sept. 29-Oct. 2, 1941.

charging pulp at various levels in the mine. It is essential that the line be kept full at all times as it will plug if air is allowed to enter at the surface. The line will also plug if there is a substantial change in the rate of flow due to sudden changes in the density of the pulp.

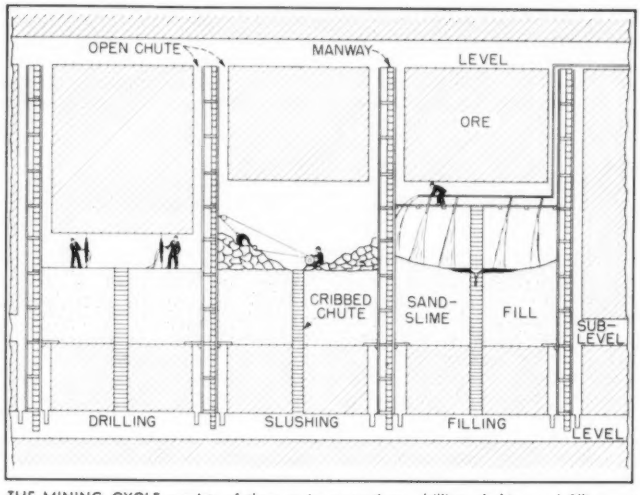
2. Storage Tank With Sluice Discharge (similar to Sliger mine): This method consists of filling a large storage tank with a center-discharge valve, similar to leaching vats or tanks used in cyanide plants. This storage tank is emptied by a sluicing mechanism into a small mixing agitator which serves to break up the lumps and acts as a surge tank to control density. This method would appear to be the cheapest to install and would require the least power, but it would call for constant attendance during the discharge cycle. Difficulty would also be had in maintaining a constant density of pulp, which is very important.

3. Batch Method by Agitation: This was the method chosen as best for our particular problem. It appeared that it would permit a constant flow of uniform pulp at a desired density, to discharge without interruption, at any volume required by the pipeline, regardless of variations of head due to the discharge points underground.

The next problem was to determine the largest size of agitator that would mix such a comparatively coarse material effectively. The Sliger operation was not comparable in this respect, as their tailings contained only 1% plus-100-mesh material, while our average tailings contain about 1% plus-35-mesh particles. Therefore, it was necessary for us to make our own estimates based on our particular requirements, which called for a tank and mechanism as shown in the accompanying illustrations.


All channels used for vertical and horizontal stiffeners, bracing, etc. are of same size and weight
4"x 2⅝"x 13.8-lb. car channel
Offset stiffener
10" pipe-14" long
Through bolts
Drain holes
Rubber stator bars for 56" Fagergren flotation machines
Bearing support
Through stiffener
Ends of stiffener channels welded to side of tank. Channel, 3 ft. long, rolled to fit curvature of tank
Bolt angle to stiffener as shown at other end
SHAFT END
Stator support plate same as top plate except for 8 equally spaced holes to fit steel rods through stator bars. Dimensions will depend upon size of stator bar used
Cover plate hole for shaft
6"x4"x½" angle, 8" long, welded to bearing support plate
Compress rubber to 13"
Bottom plates same as top except for drain holes
Offset stiffener
THROUGH STIFFENER
Through bolts
18"x 12"x⅝" bearing support plate
SHAFT

THE SUBMERGED BEARING, here seen in detail, supports the impeller shaft of agitator to prevent bending. See also page 55.



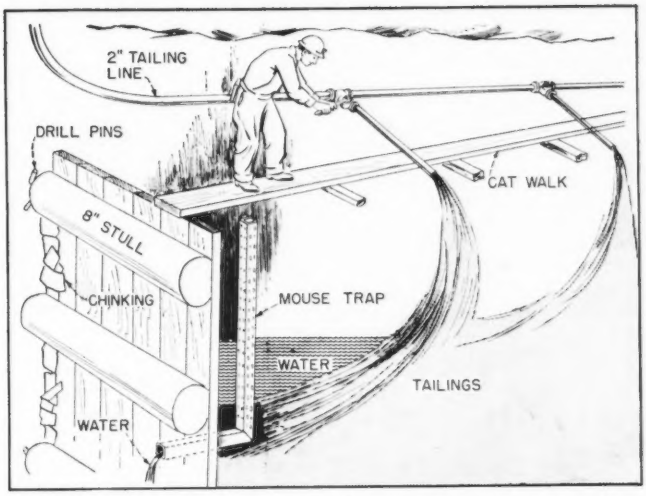
THE MINING CYCLE consists of three major operations—drilling, slushing and filling—as illustrated in this sketch.

Requirements for Agitator

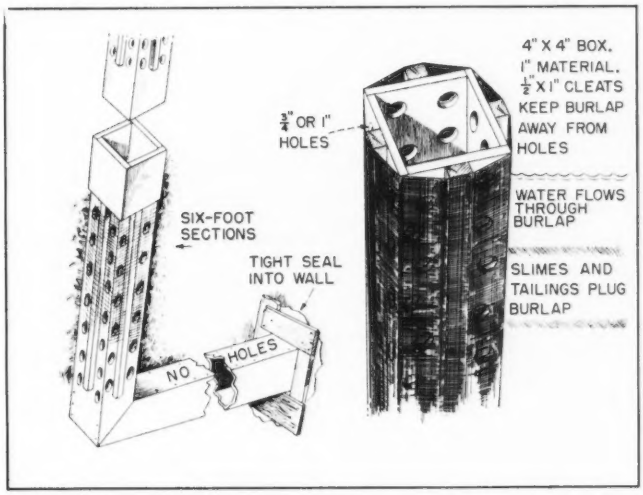
These specifications were considered adequate at the time the agitator was installed, and were based on "guesstimates" of the requirements, without precedent. Following is a brief discussion of the various requirements based on experience after two years of operation:

Supporting the tank on a raised platform, which was necessary to gain elevation, has proved unsatisfactory as it was necessary to use an excessive amount of heavy bracing to prevent the structure from weaving from the forces created by nearly 500 tons of pulp in motion. A tank of this size should be placed on solid ground, and preferably on a concrete mat with reinforcing to prevent cracking. One quarter-inch mild steel plate has sufficient strength, provided it is adequately braced. The sides of the tank have a tendency to breathe in and out, particularly when too much air is used during the starting periods. The eight, equally spaced, vertical stiffeners are more than adequate to support the weight of the superstructure, but do not stiffen the sides sufficiently to prevent distortion. Four vertical stiffeners would be enough to support the superstructure, and the distortion of the sides could be eliminated by placing horizontal stiffeners around the tank on the outside, to serve the same purpose as the steel hoops around a wooden stave tank.

The original shaft was bent, beyond repair, shortly after the tank was put into service. This was probably caused by a large mass of sand sloughing into the impeller with sufficient force to bend the



CAT WALK permits operator to reach any point along 2-in. tailings pipeline that runs above stope being filled. Note "mouse trap," details of which are shown in the sketch below.


4" X 4" BOX, 1" MATERIAL, ½" X 1" CLEATS KEEP BURLAP AWAY FROM HOLES
¾" OR 1" HOLES
WATER FLOWS THROUGH BURLAP
SIX-FOOT SECTIONS
TIGHT SEAL INTO WALL
SLIMES AND TAILINGS PLUG BURLAP
NO HOLES

"MOUSE TRAP" conceived by S. Lamb, shift boss, serves for drainage of water in stope fill. It is built in 6-ft. sections on surface and sent underground as required.

shaft, which was unsupported from the impeller to the superstructure, a distance of 16 ft. Recurrence of this failure was prevented by installing a submerged bearing, mounted on the horizontal cross-braces welded to the side of the tank at points 8 ft. above the bottom.

The submerged bearing was made by mounting rubber stator tubes from 56-in. Fagergren flotation machines in a 10-in. pipe, equally spaced so that the edges of the tubes just touched the shaft. This bearing has worked very satisfactorily and has required no maintenance. The rubber will flake, when dry, so a small trickle of water was allowed to run down the shaft to keep the rubber wet after the pulp had dropped below the level of the bearing.

The entire mass of pulp within the tank must be kept in motion with sufficient velocity at all points to support the largest particle of sand. This is a function of the size and speed of the impeller. Following are data obtained in experiments made with different size impellers:

A 3-ft. diameter impeller, rotating at 150 r.p.m., merely churned the pulp near the center of the tank, and did not create movement of a large enough mass of pulp to break down the solidly packed walls of sand.

A 4-ft. diameter impeller, rotating at 128 r.p.m., which loaded a 25-hp. motor to full capacity, was used successfully for nearly two years, with minor exceptions. A wedge of sand was left around the edge of the tank at the bottom, extending about 3 ft. up the side and out toward the center. This dead load was not harmful, and merely lessened the total output of the tank. However, the lack of speed which caused this condition increased the time required to mix the sand into a pulp.

A 5-ft. diameter impeller, rotating at 110 r.p.m., overloaded the 25-hp. motor by approximately 50% and for this reason was tested for only a short period.

This same 5-ft. impeller was reduced to 54 in. in diameter by cutting off 3 in. from the end of each blade with a cutting torch. At the time of writing this it has been in service about three weeks and has worked very satisfactorily. It reduced the time required to stir a batch of sand by about one-third, and eliminated the wedge of sand left in the bottom of the tank when using the 4-ft. impeller. The average ampere-reading, when using the 54-in. impeller, was 45 amp., which is an overload of about 30%.

Impeller Hardsurfaced

The 5-ft. impeller was cast of steel in a local foundry. Steel is superior to the white-iron castings previously used, as it will take hardsurfacing more readily. We have made a practice of hardsurfacing the worn areas every third Monday, as the tank is left empty over Sunday, when the mills are shut down.

The hardsurfacing is not a lengthy task nor an expensive one, as the only section that requires resurfacing is a narrow strip, about 2 in. wide, at the extreme end of the blades, which taper down to a thin edge. If this thin edge is kept in repair, and not allowed to eat away, the balance of the impeller should last for at least a year.

Table I gives the particle-size distribution of the mill tailings and of the thickened pulp discharged underground.

All data as outlined in this report, such as horsepower require-

Table I—Particle-Size Distribution of Tails and of Pulp Discharged Underground

Mesh	Mill Tailings % Wt.	Mill Tailings Accum. % Wt.	Agitated Pulp % Wt.	Agitated Pulp Accum. % Wt.
Plus 28	0.5	0.5	1.0	1.0
Plus 35	3.6	4.1	5.3	6.3
Plus 48	8.2	12.3	10.3	16.6
Plus 65	18.2	30.5	19.6	36.2
Plus 100	18.9	49.4	19.3	55.5
Plus 200	19.5	68.9	25.9	81.4
Minus 200	31.1		18.6	

Table II. Factors Showing Effect of Density on Flow Rate

% Solids	Tank Disch. In./Hr.	G.P.M.	Velocity Ft./Sec.	Dry Tons Hr.
64	38	178	18.1	48.1
67	36	167	17.0	47.9
70	30½	143	14.6	44.8
72	26	122	12.4	40.3
73	23	108	11.0	36.6
74	19	89	9.1	31.0
75	14½	68	6.9	24.2
76	9½	45	4.6	17.2
77	Plugged Pipeline Underground			

ments and all other factors involved in the surface operation, as well as the results of our underground operation, are based on the use of tailings with the size distribution noted. A finer product would be advantageous in regards to the surface operation as it would require less power to mix the sand into a pulp, and would also cause less wear from abrasion on equipment and pipelines. No difficulties should be had underground from the use of a much finer product, as outlined in the report on the Sliger mine, where the product delivered contained only 2% plus-100-mesh material.

The agitator, which acts as a thickener during the filling cycle, overflows a substantial amount of dilute pulp. The amount of slimes retained in the final pulp can be controlled by the length of overflow weir. Originally all the overflow product was discharged through a 6-in. pipe connected to the side of the tank, with no overflow launder. Recently we installed a short section of overflow launder with a weir 10 ft. long. This reduced the overflow velocity sufficiently to increase the minus-200-mesh material 6%.

Density of Pulp

Pulp density will have to be determined at each individual operation to meet the specific requirements which will vary according to the character of the tailings, fineness of grind, size and length of pipelines underground, pressures developed, and the location, type, and preparation of stopes.

Table II gives various factors which illustrate the effect of density on the rate of flow. In each instance the same material, with the exception of changes in pulp density, was delivered through approximately 6,000 ft. of 2-in. pipe to a vertical depth of 1,600 ft.

Pulp with a density of 74% solids gave the best results underground, and due to lower velocity would cause less wear than a pulp of lesser density. During the allotted time of 6 hr. only 186 tons could be discharged from a pulp of 74% solids. A pulp of 72% solids would discharge 242 dry tons during the same period. For this reason we attempted to maintain a pulp of 72% solids.

The 20-ft. tank has an available capacity of 15½ ft. of pulp, as the sand will settle and plug the discharge outlet when the pulp level has dropped about one foot below the impeller. At 74% solids, this 15½ ft. of available pulp will deliver 304 dry tons.

A 3-in. pipe, discharging a pulp of 74% solids, under the same conditions as outlined in the tabulation, would deliver the total capacity of 304 tons in less than five hours. This would indicate that a 3-in. pipe would have been a better choice of pipe size than the 2 in. installed before the above data was available. The increased cost of the 3-in. pipe would undoubtedly have been offset by the reduction in cost, per ton of fill, by the increase in tonnage from the same equipment with fixed overhead charges.

The tailings are pumped through a 4-in. line by a 4-in. Wilfley pump to the agitator at the rate of about 28 dry tons per hour in a pulp of 40 to 45% solids. On an average it requires 26 ball-mill hours (13 hr. with both ball mills in operation) to fill a tank with pulp of 72% solids. Filling starts each afternoon at 3 p.m. About 12 hr. later one of the mill operators measures the sand level in the tank to determine how much longer the pump should run. This is done with a wooden rod, about 2 in. in diameter and 10 ft. long, on the end of which is fastened a round metal plate about 10 in. in diameter. This is lowered into the pulp without pushing and allowed to come to rest. The rod is calibrated with notches, which indicates to the operator when the tank is full, at which time the pump is shut off and the pulp allowed to settle until morning. The day operator measures the depth of clear water above the pulp level and if necessary decants the required amount of water to produce the proper pulp density. This can be determined by a chart which was made for this purpose.

After the desired density has been established by the above procedure, the 1-in. air valve, fastened to the bottom of the tank and directly under the center of the impeller, is turned on for about 5 min. This creates a column of loose pulp around the impeller and along the shaft. The reversing switch is then set on the "Start" position (upward thrust of the impeller) and the motor started. The impeller is allowed to run with an upward thrust for about 15 min. The air under the impeller is turned off and the motor reversed (downward thrust of the impeller) and allowed to run in this direction during the entire discharging period. After the air under the impeller has been turned off, the eight ¾-in. air valves, equally spaced around the tank and 18 in. above the bottom, are turned on just enough to give a slight bubbling at the surface of the pulp. This assists the impeller in creating a rising column of pulp at the side of the tank. This air is turned off after the pulp level has dropped 3 or 4 ft. Generally it requires about 20 min. to mix the sand into a pulp after the impeller has been switched to running position.

Turning on the Pulp

A telephone is always installed near the filling area, and at a signal from the underground operator ("sand jockey") water is turned into the pipeline at the surface for 2 min. When this water spurts out of the end of the pipe, the "jockey" knows the line is clear and phones for the pulp to be turned on. This is usually about 8:15 a.m. The mill operator remains at the tank for about 30 min. to be sure the pulp is flowing underground. He then returns to the mill for his regular duties. If anything goes wrong underground, the "sand jockey" phones the hoistman, who blows a whistle to indicate to the mill operator that the flow should be stopped, at which time he again turns water into the line for 3 or 4 min. to flush it out. Flushing out the line is very important and must be done after every delivery of pulp through the pipeline. If for any reason the underground cannot take a tank full of pulp after it has been mixed, the tank is emptied, to just

below the impeller, by discharging through a by-pass valve into a launder leading to the mill tailings flume. This is done to prevent the sand from packing solidly about the impeller, which would make it difficult to start the following morning. An unmixed tank of tailings can be started with ease after several days of settlement, but after it has once been stirred, it cannot remain in the tank, even overnight, without causing difficulty in starting.

Flow Rate and Pipe Size

The rate-of-flow chart was based on tests made while filling on the 1,600-ft. level. Pipes leading off to the workings on 1,300-ft. and 900-ft. levels gave an increased rate of flow amounting to about 15% and 30%, respectively. With this general information, one should be able to estimate, within reasonable limits, what size pipe is best suited to their particular problem.

For tailings with 1 to 5% plus-35-mesh, it would be recommended that a pulp velocity of not less than 8 f.p.s. be maintained. With finer grading, say 1 or 2% plus-65-mesh, it would appear safe to drop the velocity to perhaps 6 f.p.s. In either event the allowable velocity will depend upon the viscosity of the pulp, determined by the percentage of solids and the amount of slimes retained. The aim is to maintain a pulp with as high a density as will flow freely through the pipe.

If valves are used to divert the flow to different levels, they must be installed adjoining the "Y" in the line, so that the sand will not plug the dead line between the valve and the "Y." We have found that all-iron plug cocks are best suited for this purpose. Care must be taken that the sand jockey does not inadvertently close the valve in the live line before making sure the dead line has been opened. This would surely result in a plugged pipeline.

Pipelines extending through the old workings were occasionally broken by falling rocks, which caused sections of the line to plug solidly with sand, sometimes for several 100 ft. The plugged section can be located by difference in sound on tapping the pipe. The plugged section was disconnected at the pipe union nearest the start of the plug (Unions were installed every four or five lengths of pipe). Water was turned into the line at the surface for one minute and then shut off. This built up pressure in the line, which usually forced out the sand in the plugged section between unions, although it was sometimes necessary to beat the pipe with hammers to start the sand in motion. When the plugged section was cleared, another section, between unions, was given the same treatment. The use of flanged joints or Victaulic couplings would have minimized the labor of this procedure. Fortunately it was necessary to unplug the line only four times in over two years of operation.

The threaded ends of standard pipe are worn out before the balance of the pipe. This is undoubtedly due to eddy currents created by the increased area of the coupling. Also the pipe walls are thinner at the threaded section. The added cost of Victaulic couplings would be justified for this reason, if not for the ease of disconnecting, as mentioned.

To date, a standard-weight, 2-in. pipe has handled 70,000 dry tons of tailings. Most of the joints are worn thin, and it is questionable if it will handle more than 5,000 additional tons. With butt-connected joints a standard, 2-in. pipe should be able to handle at least 100,000 dry tons. A 3-in. standard pipe would probably handle 150,000 dry tons, due to the increase in viscosity possible with a larger pipe. Experience records indicate that one ton of fill will replace two tons of rock in place.

Three Operations

The use of mill tailings for underground fill calls for three operations: Preparing the stopes for filling; conducting the fill to the stopes; and the actual filling. The first of these operations is the most difficult, especially in areas that have been mined prior to the introduction of this fill method.

The preparation of stopes for filling is a problem of making them watertight, which sounds formidable, but experience has taught us that it is not difficult, even in old stoped areas.

In previously mined areas, where all the ore was taken out above the drift, it became necessary to build walls along the level. These were built of 10 x 10-in. posts, placed vertical rather than at right angles to the dip of the vein; 3-in. lagging were used for walling. Inexperience and low density made it imperative that such walls be of sturdy construction.

In stopes the 10 x 10-in. timbers were placed at right angles to the dip of the vein, and not more than 4 ft. apart. Three-inch lagging, nailed on the inside, served for walling. It was not necessary to use tongue-and-groove material, or seal the cracks, and there was no loss of tailings between the lagging. Any space between the lagging and the irregular contour of the ground was plugged with burlap or wadded newspapers, held in place by pieces of powder boxes. To hold the 10 x 10-in. timber in place, hitches were cut in both the hanging wall and footwall, and drill holes with pieces of discarded steel were used for anchoring. Securing the timbers in the above method was necessary, as there is no squeeze in the hard walls of the Brunswick veins. Later development proved that 8-in. stulls, surfaced on one side, were less expensive and just as efficient as the 10 x 10-in. timber formerly used.

Inexperience in sand-wall construction and lack of density in the pulp were the two causes of early difficulties. The first walls built were poorly chinked and, added to this, a surplus of water caused breaks. Decanting water from the top of the fill eased the wall pressure and eliminated most of the breaks.

Conducting the Fill

The tailings pipeline is brought into the stope within 8 ft. of the back, and a catwalk built to permit access to valves for control of flow to different parts of the stope. Placing the pipe and catwalk near the back eliminated the necessity of raising them as the stope filled, and the constant attendance of the sand jockey if horses were used. The elevation of the discharge pipe in the stope occasionally was 30 to 40 ft. higher than the main incoming line. No difficulty was encountered from inclining the pipe to a higher discharge point.

Originally the pipe was brought into the stope at a low elevation and raised as the stope filled. During this procedure it was necessary for the jockey to walk on the tailings to control the valves while filling. Under these conditions it was difficult to walk in the soft fill. To overcome this "mushiness" one pound of aluminum sulphate per ton of dry tailings was added to the agitator during the mixing period. This produced a compact fill that could be walked upon with ease.

Aluminum sulphate produced a flocculated pulp through which

water would drain. Without it the mass was impervious and water would have to be drained off the surface of the fill. The latter method was considered the more practical, as provision would have to be made to drain off the water, at the bottom of the stope, when aluminum sulphate was used. When the main pipeline was brought into the stope near the back, with a catwalk for control, it was seldom necessary to walk on the fill, and the use of aluminum sulphate was discontinued.

With very fine tailings it would no doubt be essential to use aluminum sulphate at all times. Without relatively coarse tailings it has proved to be unnecessary. In either event the use of a very high density pulp, say 74% solids, would minimize the importance of both water drainage and the use of aluminum sulphate.

Filling a Stope

The normal procedure is to fill at the far end of the stope, and slope the tailings toward the timbered wall. This makes it possible to have complete control of the water where desired. Short discharge pipes from the main line are placed so that the tailings are built higher along the hanging wall. When they are discharged along the footwall a pool of water would gather along the hanging wall, and when sufficient pressure had built up a break would occur. Also the tailings would shrink away from the hanging wall, leaving an open gap about 2 in. wide, which can cause trouble if water is allowed to enter the gap. To overcome this condition the jockey mucked up sand along the hanging wall before starting the new fill.

One man (the jockey) in charge of the underground filling drilled 1-in. holes about 4 in. apart over the entire wall area. When the tailings reached a level of holes they were plugged with a wad of paper, and the water drain continued at a higher level. In this manner it was possible to keep all the water drained from the low end of the fill.

Boring holes, keeping them free of wood chips, and plugging them as the pulp rose, kept one man busy. Should he have to regulate valves to the different parts of the stope, or be away from the drain wall for more than very short periods, the tailings would drain out of the bore holes. This led to the idea of devising some simpler and more automatic method of draining water.

Several methods of water drainage were attempted before the "mouse trap" illustrated was conceived by S. Lamb, mine shift boss. The 6-ft. sections of the "mouse trap" are built and bored in the mine carpenter shop and sent underground as ordered. On completion of the sand wall, the timbermen cut the drain hole in the wall and install the trap, which is always placed along the footwall. It is at this time that the single thickness of burlap is nailed securely to the trap. When the water is continuously drained from the surface of the fill, there is little danger of break-outs due to excessive pressure, and fill can continue, without interruption, to any desired depth of fill. It is not necessary to allow the tailings to set, or dry out, before additional filling. Discharge water flows through the trap at the rate of 20 to 30 g.p.m. The smallness of this quantity of water is due to the high density of the pulp used. It is practically clear and causes no wear or extra load on the pumps.

No delays occur between filling and mining as the men are able to work on the tailings the morning after the filling is completed. Originally it was thought necessary to cover the fill with 2-in. lagging as a slushing floor. High cost of material and labor made this impractical, plus the fact that fines were lost in the space between the lagging and the walls. In the present operation, where the ore is slushed from the top of the fill, or where buried ore or pillars are mined by underhanding, very little of the tailings are scraped into the chutes by the slusher operation.

Chute Construction Simple

Cribbed chutes are constructed of 3 x 12-in. lagging, 5 ft. 4 in. long, with a 6-in. dip on either end. Construction of the chute is simple as the cribs are built in the open stope to the height to be filled, and the cracks are covered with sawmill slabs. Tailings are discharged at both ends of the stope, and water is drained down the cribbed raises. In one instance, the abrasive ore cut through the footwall side of the crib before the stope was completed, yet none of the tailings was lost out of the fill. In another instance, mining was carried alongside a filled area, leaving a vertical wall of tailings, 20 ft. high, which remained intact with no signs of sloughing.

One of the accompanying drawings shows a complete cycle of cut and fill in a long stope, in which the first section is being filled, the second section slushed, and the third section drilled.

Additional Advantages

The use of tailings for filling has other advantages, such as:

1. Stope can be filled to back.
2. Gives a higher percentage of recovery of ore than when pillar support is used.
3. Better method of support than stulls.
4. Filling of stoped areas where there are closely spaced veins makes mining easier and safer.
5. Better control of ventilation.
6. Reduces voids, thereby reduces pumping in case of flooding.
7. Stoped areas can be step-filled.
8. Bad walls can be controlled.
9. Labor cost low.
10. Permits mining of wide stopes of variable or undetermined widths.
11. Materially reduces surface subsidence where it is important.

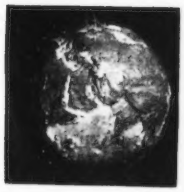
Over a two-year period the total cost per dry ton of tailings is as follows:

Pumping	$0.04
Mixing	0.03
Timbering	0.16
Placing	0.09
Total	$0.32

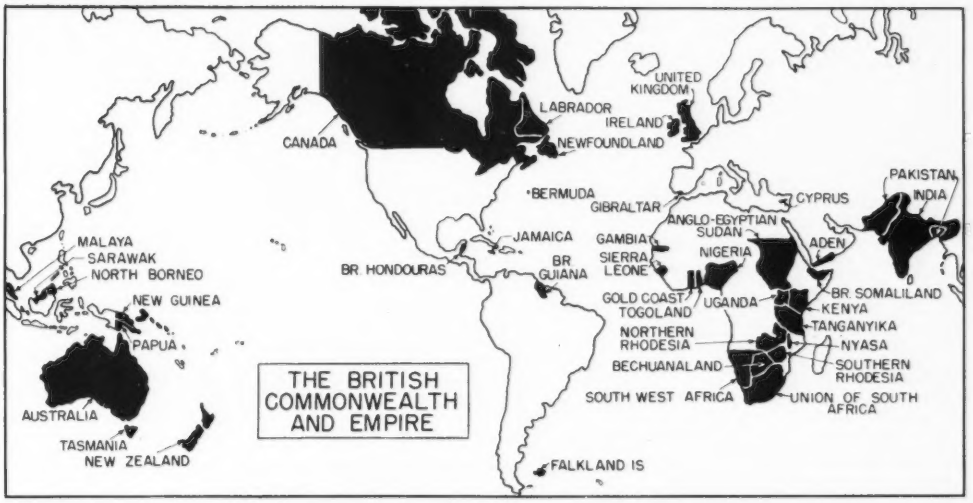
This cost includes all surface labor involved in the preparation of timber, mouse traps, maintenance of equipment, etc. It also includes repair parts and pipe used to convey the tailings to additional stoping areas. It does not include the amortization of surface equipment or the original pipeline down the shaft. Total cost of pipe, equipment, and the installation amounted to approximately $7,000. Charged against present 70,000 tons handled this would amount to $0.10 per ton of fill if written off completely in the two and one-half years of operation.

The 16-c. timbering charge covered all types of stopes which were filled, including many that had been mined without leaving pillars above the drift. When preparing stopes particularly for this fill, leaving pillars above the drifts, the timbering charge can be reduced by 50% at least.

We should like to thank the board of directors of Idaho Maryland Mines Corporation for permission to publish this paper, also to thank Neil O'Donnell, executive vice president, for reviewing the script and making several timely suggestions.



To achieve economic stability by 1952, Great Britain plans to reduce imports from non-sterling areas, and to intensify the development of mines, agriculture, and other industries in her colonies.



Mineral Resources in British Colonies and Possessions

BRITISH GUIANA—Bauxite, diamonds, tantalum
GOLD COAST—Bauxite, manganese, diammonds
JAMAICA—Bauxite
MALAYA—Tin, bauxite, manganese
NIGERIA—Tantalite, lead, zinc, mica, tungsten, columbite, tin, phosphate
NORTHERN RHODESIA—Copper, chromium, cobalt, zinc, lead, mica, vanadium, manganese
NYASA—Bauxite
SIERRA LEONE—Manganese, diamonds, chromium, iron, platinum, titanium
TANGANYIKA—Lead, mica, diamonds
UGANDA—Beryl, titanium, tantalum, copper, mica, tin

Mineral Position of ECA Nations

No. 10—GREAT BRITAIN

FREDERICK R. BREWSTER
London Bureau
McGraw-Hill World News

THE DEVELOPMENT of Great Britain's colonial resources will undoubtedly have to be intensified if the objectives set forth in her Four Year Plan for economic stability are to be realized. Details of the Plan were officially published in a White Paper on Dec. 20. Previously, an unofficial but accurate version of the Plan had "leaked out" through the Paris press and stimulated widespread comment in Europe and North America, chiefly because the proposed plan calls for progressive and drastic revision of Britain's trade with these areas.

In brief the Plan as reported would enable Britain to pay her way by 1952. This is in accord with the intent of the Marshall Plan which requires recipients of aid to work toward that end. To accomplish this, the Plan anticipates that purchases from the Western Hemisphere (virtually the dollar area) will be decreased from £721 million in 1947 to £472 million in 1952-53. Sales to the Western Hemisphere are expected to increase from £165 million to £364 million in 1952-53. In prewar years Britain bought more from Western Europe than she sold and incurred heavy trade deficits as a result. The new play proposes to eliminate this deficit. On a world-wide basis the Plan envisions a pattern of trade which

United Kingdom Imports of Ores and Concentrates

IN TONS

	1938	1947	1948 (9 mos.)
Antimony, ore and concentrates	10,625	12,215	9,722
Asbestos, chrysotile	50,861[1]	42,093	48,667
Asbestos, other sorts	.....	24,890	17,289
Bauxite	249,598	163,711	252,676
Chromite, and chrome-iron ore	37,638	87,773	82,687
Copper ore, almost entirely from Canada	29,569	21,500	18,618
Manganese ores, from Gold Coast	13,991	190,941	175,451
Manganese ores, from India and Pakistan	172,441	34,027	69,351
Manganese ores, from Union of So. Africa	1,015	43,907	59,899
Mica slabs	732[2]	1,238	679
Mica splittings	1,862[2]	3,707	1,705
Tin, ores and concentrates from Nigeria	10,967	12,578	9,164
Tin, ores and concentrates from British Malaya	2,899	.....	.....
Tin, ores and concentrates from Bolivia	30,466	24,563	23,063
Titanium, ores and concentrates	16,813	71,240	47,730
Zinc, ores and concentrates from Australia	108,779	110,539	100,676
Zinc, ores and concentrates from Newfoundland	45,674	9,077	6,531
Zinc, ores and concentrates from foreign countries	2,866	10,869	9,840

[1]Includes all sorts of asbestos.
[2]About 75% from India and Pakistan.

will net Britain a £100 million credit balance by 1952-53 instead of the £282 million deficit estimated for 1948. To accomplish this, Britain's productivity will have to increase. As an indication that this is anticipated, it might be cited that consumption of primary copper is expected to increase from 356,000 metric tons reported for 1947, to 427,000 metric tons in 1952-53.

Plan Indicates Trend

Although the success of the Four Year Plan is by no means assured at present, the Plan does indicate how future trade may be channeled or altered. The mining industry will be concerned with questions like these: How will intensified development of Rhodesian copper deposits affect western hemisphere markets? If Britain's trade with the Western Hemisphere alters, will Canadian metals be shunted to the United States? If Britain curtails imports from Western Europe, how will this affect mineral consumption in those countries, and where will they cultivate new markets? In searching for the answers to these questions it should be borne in mind that world-wide industrialization will involve higher living standards, and increased metal consumption. To accomplish this new mineral fields will have to be developed, and new trade patterns established.

Britain has already mapped out a vast program to expand colonial production, including minerals, before ECA's Strategic Minerals mission started. Africa was the principal target, calling for an investment of $4 billion from three sources: the British Government, $700 million in grants and $600 million in loans; the Colonial governments, $1.5 billion, of which $720 million has already been approved; and private British capital, estimated to be ready to invest more than $1 billion.

ECA's procurement mission will fit neatly into this pattern by facilitating and expediting going projects and encouraging new ones by such means as interesting American capital to venture into mineral development in British possessions. The ECA mission through its London office and through the Paris OEEC reports smooth progress and ready acceptance by British authorities.

What ECA Hopes to Do

ECA's aid is now directed at:

1. Breaking transport bottlenecks through expediting delivery of railway equipment for overloaded African railways. This will aid in getting ores to ports and coal to smelters. Delivery of unloading machinery at ports will be speeded up—with Beira, on the east coast of Africa a key target. Here, ECA is urging real "cooperation" between U. S., Britain and Portugal (owner and operator of Beira port).

2. Speeding the flow of machinery where it is needed. Much of this will come from British builders. Officially, the British say they can handle these orders and that there is no shortage of mining machinery. However, ECA tackles the situation as it finds it, working behind the scenes to assist the purchaser to get his machinery as fast as possible—whether by wangling steel or parts for the builder, or by pointing to alternate sources offering faster delivery.

3. Finding trained men where the local operator (or Colonial Government) runs short. First such step was a recent appeal for 25 geologists and 25 to 30 trained topographers and surveyors for work in West Africa. ECA has attempted to recruit these from America during the temporary shortage of such experts in the Colonial Service.

4. Seeking ways to provide financial assistance where the vast program outlined above falls short. Several possible ways are: (a) direct ECA grants or loans in dollars to the Government planning mineral projects for the purchase of dollar-priced machinery or supplies; (b) Export-Import Bank dollar loans to mining operators for the same goods; (c) local-currency loans or grants including the use of "counterpart funds" for locally-purchased equipment, supplies and labor to mining companies producing strategic materials; and (d) ECA encouragement of additional investment of American capital.

Increased Output Sought

The chief aim of ECA's mission as outlined by its leaders here in London and on the Continent is to encourage expansion of mineral production *beyond present goals* so that ample critical materials will be available for stockpiles of U.K., U.S. and other nations. It is hoped that by this cooperation between nations, Africa's mineral resources will be brought into full production.

Bauxite. For U. K. aluminum production, bauxite is obtained mainly from the Gold Coast. The aluminum-producing industry now operates at its capacity of 30,000 tons per year. U. K. imports much finished aluminum from Canada, which depends largely on British Guiana for bauxite. The Aluminum Company of Canada has also obtained options on Gold Coast bauxite. Here also the West Afri-

can Aluminum Co. is considering a hydroelectric plant on the Volta River to produce aluminum from ores. Total reserves of bauxite in the Gold Coast are estimated to be 229,430,000 tons. Gold Coast production, chiefly that of British Aluminum Co., Ltd., was 118,454 tons for the year ended Mar. 31, 1947.

British Guiana has large high-grade bauxite deposits near the Demerara, Ituni and Berbice rivers. Exports in 1946 totaled 1,120,015 tons. Reynolds Metal Co. obtained two exclusive prospecting concessions in 1946 covering 538,900 acres.

Malaya has not resumed post-war production. However, it is reported that Australian, British and Canadian interests plan to prospect in Johore, Malacca and Pahang. Production for 1942-3-4 totaled 395,450 tons.

Jamaica's high-grade bauxite reserves have been estimated at more than 315,000,000 tons. (E& MJ, June, 1948, "Caribbean Aluminum Ores" by O. C. Schmedeman.)

Nyassaland is estimated to have 60 million tons of bauxite reserves now being explored by Anglo-American Corp. of South Africa.

Beryllium. Uganda produced 18 tons of beryl in 1944. No production was reported in 1946.

Chromite. During the first half of 1946 production in Sierra Leone was kept low pending liquidation of stocks at Hangha held against a wartime contract. Activities were confined to prospecting. Production during the second half of 1946 totaled 10,138 tons of marketable hand-sorted ore.

Cobalt. Northern Rhodesia is the principal source of cobalt in the British Empire, the metal being recovered from converter slags of the N'kana copper refinery as a cobalt-iron-copper product containing 39.21% cobalt. Most of this is shipped to the Deloro plant in Canada for extraction of cobalt metal. Production of cobalt content in 1947 was 20,356 cwt. N'kana mine continued to be the only producer at the end of 1947.

Columbite. Nigeria is the largest producer. Production for all years up to the end of 1946 totaled 9,746 tons, most of which has been exported to the U. S. Production in 1946 was 1,550 tons.

Production of tantalite-columbite minerals practically ceased in Uganda in 1946.

Northern Rhodesia Copper Production, 1947, in Tons

	Mufulira	Nchanga	N'kana	Roan Antelope	Total
Ore treated	1,633,182	622,502	2,312,052	2,534,017	7,101,753
Recovered: —blister	53,155	23,016	6,350	53,703	136,224
—electrolytic	.....	.....	56,276	.....	56,276

Copper. Northern Rhodesia possesses copper ore reserves of at least 750 million tons of high-grade ore. Deposits are being worked by four companies. (See table.) In 1947 production was curtailed somewhat because railroads could not haul enough coal to operate metallurgical plants at capacity. Cost of production is low compared to that of U. S. Expansion of electrolytic refining capacity at N'kana is progressing. ECA estimates that U. K. will supply most of the plant, but some equipment will be needed from the U. S. If production is expanded adequately, Rhodesian mines may be able to supply all of Britain's requirements for blister and electrolytic copper, thereby relieving one large drain on her dollar supply.

Copper deposits were found in Western Uganda, and in 1947 the Frobisher Exploration Co. of Canada obtained a concession to work them. Thus far one million tons of ore have been proved, but transport will be costly and requires that 7 to 10 million tons must be proved to make the project pay.

Industrial Diamonds. On Oct. 8, ECA's Strategic Minerals Division purchased $4 million worth of industrial diamonds from British sources, Washington advices have subsequently revealed. British colonial reports show the following production of industrial and gem-quality diamonds combined: Gold Coast exports 1946-7, 753,088 carats valued at £624,718; Sierra Leone exports in 1946 (Sierra Leone Selection Trust, Ltd.), 559,231 carats valued at £806,412; Tanganyika exports, largely gem-quality, totaled 119,446 carats valued at £981,833 in 1946; British Guiana production in 1946 was 30,957 carats, or double the 1945 output.

Lead. Northern Rhodesia output has been rising steadily from a low point in 1943 to 15,640 tons in 1947. Most of the pig lead is exported to the U. K. and Union of South Africa.

In Tanganyika, Uruivira Minerals, Ltd., a Belgian company, is completing a 100-ton pilot mill at the Mukwamba orebody at Mpanda. Here a vertical shaft is being sunk to 1,000 ft., and a 130-mile branch railway is being constructed. Chief delays are rising costs of equipment and slow deliveries.

In Nigeria there were 9 mining leases for lead exploration and development covering 252 acres at the end of 1946. Gold & Base Metal Mines of Nigeria is one of the companies interested in Mines Development Syndicate of West Africa, Ltd., which is developing lead-zinc deposits in Nyeba, southern Nigeria. It is reported that a mining field of rather large extent may be developed there.

Manganese. Gold Coast possesses what is probably the largest manganese mine in the world—the Nsuta mine, 39 miles from Takoradi harbor, owned by African Manganese Co., Ltd. This mine and a smaller one at Yakau exported 769,509 dry tons of ore during the year ended March 31, 1947. Before the war 53% of Gold Coast manganese exports went to U. S., 2% to Canada, 25.9% to Norway, and 9.3% to the U. K.

The U. S. is now getting about 40% of Gold Coast's manganese production—some of it directly, some of it via Canada and Norway where it is converted into ferro-manganese or silico-manganese. Deliveries from Gold Coast are proceeding normally, and there are no apparent obstacles.

Other deposits in Northern Rhodesia, Malaya and Sierra Leone have fallen idle.

Mica. Tanganyika's exports dropped to 72.3 long tons in 1946; Northern Rhodesia's production was nil in 1947, although mica fields in the southern province offer substantial inducement to capital if properly developed. Uganda's production also dropped to nil in 1946, from 25,816 tons in 1944. Nigeria so far has found no market for its muscovite mica, large in size but poor in quality.

Tantalum. Nigeria produced ore valued at £1,333 in 1946, all of which went to U. K. Uganda's

production of tantalum minerals dropped from 6.75 tons in 1944 to practically nothing in 1946. British Guiana has granted two exclusive prospecting permits covering 20,325 acres covering potential deposits on the Rumong-Rumong River and in the Morabisi area. Little work was done by the end of 1946.

Tin. The Tin Study Group in London reports that it is known that the U. S. definitely intends to accumulate 200,000 to 300,000 tons of tin in its stockpile over a period of years.

British tin mines are practically idle. However, in August, 1948, the Cornish Mining Development Association presented a long memorandum to the Minister of Fuel, pointing out that the mines still have considerable reserves, and that the world supply situation seems to call for all the tin that can be produced. The Association urged one of two courses:

1. Encouragement of free enterprise through taxation relief, higher priority on manpower and machinery, facilitating the acquisition of mining properties, a return to free market prices for tin, and Government assistance through research, etc.

2. Establishment of a Statutory Corporation to operate as a partnership between state and industry in exploring, sinking new shafts, unwatering old mines, and developing production methods best suited to the Cornish deposits.

A reply may be forthcoming in the Minister's report early in 1949.

Malay Recovery Slow

Malaya is the British Empire's chief source of tin, producing 30% of the world's prewar total. Restoration of the tin mines from the effects of the Japanese occupation is the chief problem. Among other things, the Japanese operators did a poor job of disposing of tailings. Objective is to restore production to the 1946 level of 6,699 tons monthly average production. Output in 1947 was only 27,026 tons for the full year. The target schedule for 1949 is 73,500 tons, but progress is behind schedule. Normally half of Malaya's production is by dredging, about 36% by gravel-pumping. The Storke report considers that out of 126 dredges, 104 were suitable for repair, the other 22 were to be scrapped.

Dredging production is held back by labor unrest, lawlessness, high cost of labor and materials, and slow-delivery of dredge parts. Reduction in deliveries of good coal slowed down power plants, resulting in a daily 3-hr. shutdown of electrically-operated dredges.

Gravel-pump operations, mostly by Chinese operators, have jumped back more satisfactorily, producing 8,827 tons in 1947. Progress is due largely to financial help from the Chinese Tin Mines Rehabilitation Board.

Financial aid to European Mines has been extended by the Colonial Office, in London, and the Malayan Industrial Rehabilitation Finance Board. Additional assistance comes from the Machinery for Mines Scheme set up by the British Ministry of Supply in 1945. It has aided in ordering $6 to $7 million for distressed mines, most of which is for diesel engines.

Texas Smelter Subsidized?

Malayan producers object to the removal of the additional duty on tin ore exports that are destined for smelting elsewhere than in British smelters. The British Government states that this additional duty was removed because of the Geneva Agreement (I.T.O.) as being contrary to its provisions, but it can be reimposed if the U. S. Government subsidizes its own tin-smelting industry. Malayan producers call for it to be reimposed because "it is openly admitted by Americans that the Texas City smelter is subsidized." They appear to be afraid that Texas City will obtain Malayan concentrates at the expense of the Penang smelter—but this would require a very high U. S. subsidy to overcome the freight differential.

Producers also call either for a reopening of the London Metal Exchange or for a guarantee for three years of the present price of tin so that they can make solidly-based plans for development "untroubled by the present conditions of uncertainty."

In general, Malayan producers are "restrictive-minded," and see that expanding production beyond consumption only leads to lower dollar earnings, even though Malayan mines would not be forced out of production because they are low-cost producers.

Nigeria's tin production was stimulated during the war, after the Japanese overran Malaya. Operators concentrated on the richer seams of ore now reported to be nearing exhaustion. Extensive surveys have been underwritten by the Colonial Government to find new deposits, and a company has been formed under the control of the Nigerian Government to prospect for tin in the Cameroons which are under Nigerian control. New deposits, new machinery, and lower production costs will be needed to stimulate Nigerian production.

Nigeria Tin Goes to U.K.

In prewar years Nigeria supplied about 10% of the world production of tin. Production in 1946 was 13,756 tons, all of which was bought by the British Ministry of Supply. Refineries in U.K. mix the high-grade ores of Nigeria with inferior Bolivian ores. Britain is therefore the main argument against erecting a refining plant in Nigeria.

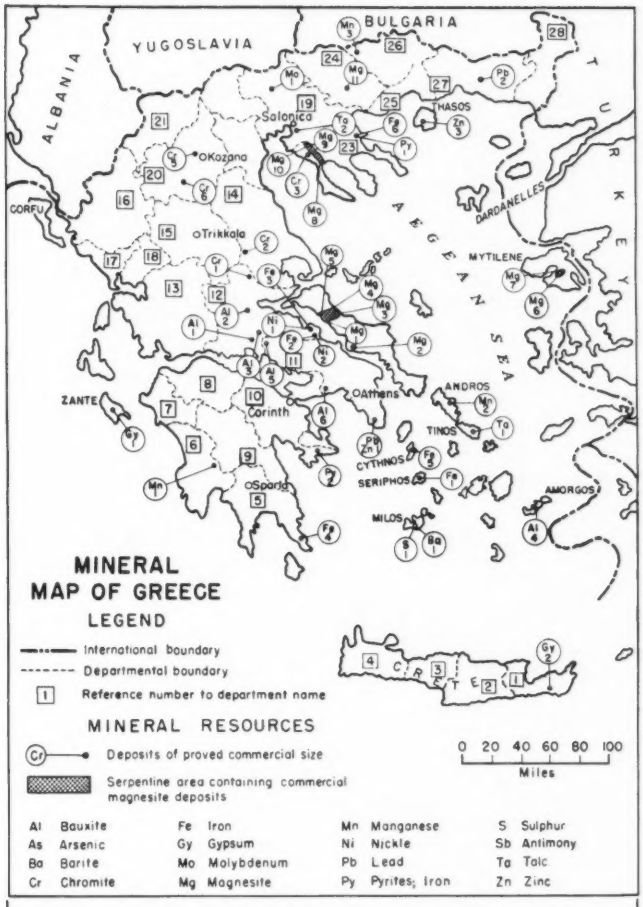
Tungsten. British consumption of refined tungsten before the war was 2,000 tons per year, of which 60% came from Burma (now a Commonwealth country, not a possession). The Ministry of Supply maintains official stocks, selling only to consumers who are unable to obtain supplies elsewhere. At present tungsten is scarce, and most of the demand is met by official stocks, currently at a rate of 2,350 tons per year. During the war the British Government stimulated small African producers by offering to buy at a guaranteed price, but when commercial buying resumed after the war this production dried up.

In Uganda a new mine opened up in the Kigezi district at Mutolare, producing 88 tons in 1946. Nigeria's production was only 4.54 tons in 1946. Negligible amounts were produced in Malaya in prewar years.

Vanadium. Northern Rhodesia resumed production of fused vanadium pentoxide at Broken Hill. 1947 production was 99 tons.

Zinc. Northern Rhodesia output, all from Broken Hill, was 21,140 tons in 1947, of which 15,753 tons sold as electrolytic zinc chiefly to U. K. and India, and 6,357 tons debased to 99.00% for South African market.

Iron Ore. Prospecting in Northern Rhodesia has revealed 800 million tons of high-grade, high-silica iron ore, and more than 40 million tons of high-grade hematite. Bethlehem Steel Co. has obtained a prospecting license to explore iron deposits in Nigeria.



Departmental Reference Numbers

CRETE
1 Lasithion
2 Heraklion
3 Rethymno
4 Canea

PELOPONNESUS
5 Laconia
6 Messenia
7 Elis
8 Achaia
9 Arcadia
10 Argolis and Corinth

CENTRAL GREECE
11 Attica and Boeotia
12 Phthiotis and Phocis
13 Aetolia and Acarnania

THESSALY
14 Larissa
15 Trikkala

EPIRUS
16 Janina
17 Preveza
18 Arta

MACEDONIA
19 Salonica
20 Kozane
21 Florina
22 Pella
23 Chalcidice
24 Serres
25 Kavalla
26 Drama

THRACE
27 Rhodope
28 Hebros

Mineral Producing Areas in Greece[1]

No. on map		Property	1938 Production Metric Tons
Iron Ore			
Fe	1	Island of Seriphos	112,140
Fe	2	Tsouka	86,483
		Loutsi	64,938
Fe	3	N. Kokino	1,942
Fe	4	St. Elisse	755
Fe	5	Island of Cythnos	14,300
Fe	6	Stratoniki	37,000
Chromium Ore			
Cr	1	Xinia	21,654
Cr	2	Tsagli	13,535
Cr	3	Vavdos	1,933[2]
Cr	4	Gomati*	1,100[2]
Cr	5	Rodiani	1,950
Cr	6	Burinos	3,350
Manganese Ore			
Mn	1	Zerbissa	3,317
Mn	2	Island of Andros	2,200
Mn	3	Kato Nevrokopi	453
Molybdenum			
Mo	1	Axioupolis	—
Nickel Ore			
Ni	1	N. Kokino	50,306
Ni	2	Karditsa	—
Bauxite			
Al	1	Topolia	56,563
		Amphissa	35,397
Al	2	Caniani	37,989
Al	3	Agoriani	—
Al	4	Crikelos	28,000
Al	5	Distomo	—
Al	6	Mandra and Megalopefco	21,937
Lead and Zinc Ores			
Pb-Zn	1	Laurium District[3]	....
		Plaka mine	....
Pb	2	Komotini	—
Zn	3	Island of Thassos	—
Sulphur			
S	1	Island of Milos	548
Barite			
Ba	1	Island of Milos	34,700
Gypsum			
Gy	1	Island of Zante...(est.)	7,000
Gy	2	Sitia	9,436
Iron Pyrite			
Py	1	Stratoniki	215,000
Py	2	Ermioni	29,000
Magnesite			
Mg	1	Galataki	20,964
		Troupi	10,667
Mg	2	Afrati	9,723
Mg	3	St. Triti	8,072
		Livadokia	6,918
Mg	4	Montoudi	22,800
		Dafnopotamos	1,504
Mg	5	Limni	9,191
Mg	6	Vassilika (3 workings)	17,211
Mg	7	Vouvari	1,479
Mg	8	Gerakini	27,838
Mg	9	St. Paraskevi ....(est.)	5,000
		Tricorfon	2,520
		Aconorachi	2,522
		Galarinos	2,000
Mg	10	Vavdos	15,280
Mg	11	Litsa	1,040
Talc			
Ta	1	Island of Tinos	943
Ta	2	Chortiati	350

*Not located on map.
[1]Map and statistics from U.S.B.M., Foreign Minerals Survey, Vol. 1, No. 5.
[2]1937.
[3]Camarisa mine produced 1,825 tons of 42% lead ore and 6,603 tons of 46% zinc ore in 1938; Plaka mine produced 9,805 tons of 13% lead ore and 7 tons of 25% zinc ore in 1938; Laurium smelter produced 6,050 tons of 98.8% lead in 1938.
Dashes indicate not reported.

No. 11—GREECE

O. PERRY RIKER, Consultant, Mining Section, E.C.A. Mission to Greece, Prepared in cooperation with Athens Bureau, McGraw-Hill World News

Development of the Greek mining industry is high on the agenda of things to be accomplished during the 4-year program of ECA. Along with industrialization and the rehabilitation of agriculture, an increase in mineral output and development of metallurgical processing of some ores are considered prime essentials in the

Greece. Production and Exports of Principal Mineral Products

AVERAGES FOR 1936-39, incl.[1]

Mineral	Production (metric-tons)	Sales in U. S. dollars, 1938	Exports (metric-tons)	Range in Grade 1938 (percent)
Barite	32,000	117,000	28,000	94-97 $BaSO_4$
Bauxite	159,000	406,000	132,000	56-63 Al_2O_3
Chromium ore	50,000	455,000	48,000	32-52 Cr_2O_3
Emery	10,000	192,000	11,000	.....
Iron ore	310,000	644,000	256,000	20-55 Fe
Lead ore	17,000	.....	.....	13 Pb
Lead, pig[3]	5,000	131,000	1,500	.....
Magnesite	143,000	314,000	89,000	89-98 $MgCO_3$
Manganese ore	7,000	15,100	2,000	38-52 Mn
Nickel ore	48,000	282,000	43,000[2]	2.4 Ni
Pumice	186,000	50,000	700	.....
Pyrite	219,000	977,000	177,000	40-48 Fe
Zinc ore	9,000	94,000	11,000[2]	25 Zn
Total		3,926,100		

[1]Source: U.S.B.M. Foreign Minerals Survey, Vol. 1, No. 5.
[2]Averages for 1937-39, incl.
[3]Smelter owned by Compagnie Francaise des Mines du Laurium.

Greece. Metal and Mineral Imports—1938[1]

(IN METRIC TONS, Unless Otherwise Indicated)

Aluminum	307	Mercury, flasks	178
Asbestos	90	Nickel	12
Copper		Sodium nitrate	7,938
Pig	25	Phosphates	74,633
Sheets, tubes, etc.	3,648	Potash	567
Pipes	592	Sulphur	18,382
Sulphate	8,464	Tin	254
Iron		Zinc	1,025
Pig	11,456	Lead	....[2]
Unwrought, rolled	67,998		

[1]Source: Bulletin Mensuel du Commerce, Special Dec. Issue.
[2]None reported for 1938, 235 tons in 1935, and 27 tons in 1937.

economic recovery of Greece. To this end the Government of Greece with the assistance of the ECA Mission is conducting an extensive survey to determine possibilities for over-all stimulation of the industry. It is anticipated that the survey may result in the discovery of other minerals, including gold in commercial quantities. Geologists and geophysicists are scheduled to come to Greece to participate in the survey.

Bandits Retard Production

Production of ore and concentrates has dropped during 1948, principally because of insecurity in mining areas as a result of the war against the bandits. It is estimated that output of ore and concentrates will total approximately 120,000 tons, valued at some $2,400,000. This compares with an output of about 850,000 tons, values at $8,500,000 during 1938. (See also accompanying tables of production, imports and exports from U.S.B.M. Foreign Minerals Survey.)

As a result of considerable damage suffered during the war and occupation, Greek mines will require some $4,500,000 worth of imported machinery and supplies almost immediately, if development is to reach any sizeable proportion within the next four or five years. The total estimated requirements up to 1953 will cost approximately $11,000,000. With these installations, plus the utilization of new power which is expected to result from hydroelectric development, Greek mines should be able to produce an annual output of 1,900,000 tons of ore and metallurgical products valued at $32,500,000.

The bulk of Greece's minerals, consisting of bauxite, magnesite, barite, chromite, manganite, pyrite and iron-ore is exported as raw ore. Lead-zinc ores are concentrated at the mines by selective flotation. The lead concentrate is smelted and refined locally. Lead-sheets, litharge and minium are produced for home consumption. Zinc concentrate is exported for refining.

Technical Help Needed

Lack of technical personnel who are capable and willing to work and live in the areas where the mines are located has long been a serious handicap to the mining industry of the country. Since 1940, with security almost totally lacking, this situation has become acute. This lack of constant technical supervision, together with the absence of mechanical modernization, is reflected in higher mining costs and lower output per man-shift. At present this production per man-shift is only one-fourth ton compared with an approximate two tons in the United States. Currently, chromite and manganese mines are not producing, but it is estimated that the former, when back in operation, should produce around 80,000 tons annually of 30 to 40% grade. Production of manganese, battery grade, is expected to reach an annual output of 7,000 tons.

Mines to be Modernized

The present plan for rehabilitation is aimed at overcoming these difficulties, the objective to be the establishment of Greek ores and minerals in world mineral market competition. Not only are the mines to be modernized equipmentwise, but adequate transportation facilities to and from remote sites are planned along with housing projects to raise living standards at the mines.

Particular emphasis is being placed presently on development and production of lignite, of which there are large reserves of a low-grade product, in order that it may be utilized in planned thermo-electric plants. This will augment the scheduled hydroelectric power output, as well as decrease the importation of fuel oil now being used for the production of electrical energy. It is certain that lignite will be of increasing economic importance as soon as modern methods of mining and uses are applied in Greece.

This series of articles on "The Mineral Position of the ECA Nations" contributed by foreign correspondents of the McGraw-Hill World News will be concluded in the March 1949 issue of E&MJ. Significant developments in the changing world mineral economy and their probable effects on the domestic mining industry will be evaluated in a future issue.

Mechanized Drifting Speeds Development Work

Headings 9x7 ft. in cross-section are advanced 112 ft. per week by methods described

JOHN B. HUTTL
Associate Editor

ADAPTATION OF METHODS used by expert contractors in big tunnels to ordinary drifting has speeded up underground development work in Anaconda's mines at Butte and reduced its overall cost. This has involved the careful selection of equipment for drilling, mucking and transportation; also good organization, experienced direction and co-ordination of the different working phases. To illustrate this, I will take a two-heading operation and a one-heading operation, both in the Badger State mine.

The heading, known as A-1680 XCNE and A-1683 XCN, on the 1,600-ft. level, are driven 9x7 ft. in cross-section. The ground is slightly altered and medium-hard granite. It drills easily, with little plugging of the steel, and breaks on blasting to a size easily handled by mechanical muckers.

Equipment Up-to-Date

The round averages 29 holes, including the burn cut. It is drilled with two Sullivan T-350, 3½-in. drifters mounted on a Sullivan Hydro drill jib. Liddicoat bits on 1-in. quarter-octagon steel are used. Auxiliary equipment includes 12-ft blowpipes, 12-ft. x 1-in. loading sticks, and an ACM-type chain steel puller, a 1½-in. air hose and a 1-in. water hose, each 50-ft. long. Starters are 7 ft. 9 in. long and take 1 19/32-in. bits. The next length of steel is 11 ft. With this 1½-in. bits are used. Mucking is done with an Eimco 12-B Rocker shovel with a toothed bucket.

For transportation, two battery locomotives are employed. One works entirely inside, servicing drift mucking. The other trams 5-car trains 2,100 ft. to the pocket at the station. There are twelve 57-cu. ft. Granby-type cars. At the pocket there is a stationary dump block with butt switches at either end for bypassing. Tracks are of 40-lb. rail, spaced 18 in. and resting on wooden ties (5 ties per 15-ft. length). Latch-type switches equipped with safety reflectors are used.

The arrangement for transferring cars replaces the conventional cherry picker. To install it a relatively small space must be blasted out at the side of the drift. These widened sections are spaced at previously calculated intervals, not longer than 200-ft. Operation is as follows:

1. The train with empty cars is run a short distance beyond the transfer point. 2. The last car is detached and placed on the carriage of the car transfer. 3. Carriage and car are rolled into the storage chamber at the side of the drift. 4. The train is run back and the empty car on the carriage rolled onto the track and attached to the front end of the locomotive. 5. The train is then run to the face after detaching and rolling what is now the last car into the storage chamber. The car in front of the locomotive is loaded by shovel. The train is then run back, the transfer of a car repeated at the transfer point, and so on until all the empty cars behind the locomotive have been shifted up in front of it and loaded.

Ventilation is provided by two 5-hp. high-speed American Blower fans. These pick up fresh air inside at the Pilot Butte shaft and transfer it to the drift heading via a 21-in. Ventube fan bag. The 3-in. air-line and 2-in. water line are laid in 21-ft. sections with Victaulic couplings.

The burn-cut round is blasted with DuPont No. 2 Gelex, of 45% volume strength and 1⅛ in. in diameter. For primers, Western Big Inch blasting caps are used with 16-ft. lengths of Lion Brand fuse. Bunch blasting is practiced. A typical layout of the 29-hole round is shown.

The Two-Heading Operation

In the two-heading operation, with two contract miners employed, the working cycle in the drift is as follows: The man in the heading which was blasted on the previous shift inspects it; bars down; wets down; moves the mucking machine into the heading; mucks out the broken rock; and does all necessary track work. The man in the heading which was mucked out on the previous shift sets up the drill jib; drills the round; tears the drill jib down and moves it to the other heading at the end of the shift, this heading having been mucked out in the meantime. He then blows and loads the holes and blasts the round.

All pipe work is done before 8 a.m. At that time the fan bag is also strung back. Following the day-shift blast, the afternoon shift boss attends to the fan bag before the night-shift miners arrive. Whenever possible, surveying is done at such time during the regular day shift as will result in the least delay in operation.

In the single heading, A-1680

(*Continued on page 138*)

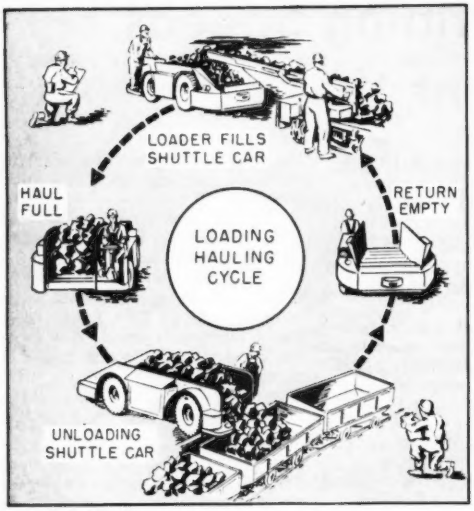
TABLE I. Operating Results in Two-Heading Operation

Total weekly advance, week ended 1/31/48	112	ft.
Total weekly advance, week ended 2/ 7/48	112	ft.
Total contract shifts per week	24	
Average advance per round (one round per 8-hr. shift)	9⅓	ft.
Advance per man-shift	4.7	ft.
Average number of cars mucked per pound	21	
Average holes drilled per round (4-hole burn cut)	29	
Average number of sticks of powder per round	430	
Operating air pressure	84–91	psi.

TABLE II. Operating Results in Single-Heading Operation

Total advance for week ending 1/3/48	87	ft.
Total contract shifts	24	
Average advance per round	7¼	ft.
Advance per man-shift	3.6	ft.
Average number of cars mucked per round	15	
Average holes drilled per round (3-hole burn cut)	28	
Average number of sticks of powder per round	340	

OBSERVERS COVER COMPLETE LOADING-HAULING CYCLE, ...



TWO OR MORE OBSERVERS, using synchronized watches, are spotted at strategic points to note all actions and delays.

BEFORE MAKING FIELD STUDIES, observers learn time-study method thoroughly, and memorize 15 symbols shown at right.

New Time-Study Method

After considerable research work and actual tests in mines, Penn State College has developed a time-study method which puts the finger on waste motion, delays, faulty planning in a costly mining cycle—that of loading and hauling. E&MJ is happy to present this method which, although applied to shuttle-car haulage in coal mining, will prove equally useful to the metal and non-metallic industries because: 1. Shuttle cars are being used increasingly in these fields, 2. the system can be modified to apply to other mining cycles, and 3. once adopted, the standard method can be used to compare efficiency of one section with that of another, or reveal the change in efficiency in a given section from month to month.

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Mineral Industries Experiment Sta.

DAVID R. MITCHELL
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Pennsylvania State College
State College, Pa.

THE TIME STUDY METHOD developed at Penn State College was applied to loading and hauling in coal mines because these operations account for 33% of production costs. The purpose of the time study method is to put the finger on loading and hauling costs and to reveal remedies which will increase productivity and profits. Attention was directed to shuttle-car loading, because more than 3,000 of these units are in use in mines in this country.

Most production studies will tell how much better one section of a mine performs than another, but less frequently do they tell *why*. This is because usual systems of measurement do not take into account three vital elements of a working section—*men, machines and layout*. Another weakness of some methods is the failure to study a complete cycle. For instance, loading time is meaningless unless studied as a component of an overall loading-hauling cycle where haulage delays may contribute to loading delays.

Thus, this method combines (1) a time study of loading and gathering cycles; (2) a method study that examines mine layout; and (3) a production study by which you can rate your sections as to efficiency. The time-study method presented here is applied to shuttle-car production units which generally include a mobile loader, one or more shuttle cars, a drill and a cutting machine. Slight modifications permit using this method for other mechanical units.

The general procedure is as follows: One observer is stationed at the loader; another at the discharge station. Both keep a time record, and note all loading and gathering activities within their scope of observation. This gives a complete continuous time record of the loading and gathering cycles for later analysis.

An accurate map of the section is used on which are noted shuttle car routes and passing points. Distances are scaled from the map so shuttle-car mileage can be figured. This map is helpful in planning better section layout.

Statistics of the number of men, machines and production achieved

. . . RECORDING ALL ACTIONS ON STANDARD FORMS

FIELD FORM A THE PENNSYLVANIA STATE COLLEGE
MINERAL INDUSTRIES EXPERIMENT STATION

TIME STUDY OF LOADER AND SHUTTLE CAR

MINE	SECTION	DATE	FIRST PLACE WORKED	OBSERVER
840	841-A	6-5-48		I.N.H.
		SHIFT 2		

SHUTTLE CAR NO 1			SHUTTLE CAR NO 2			REMARKS	SHUTTLE CAR NO		
Symbol	Observed Continuous Time	Working Time	Symbol	Observed Continuous Time	Working Time		Symbol	Observed Continuous Time	Working Time
ST	00 00		ST	00 00		STARTING TIME 08.00			
DM_S			PC	09 10		TO 45 FACE			
			L	11 25					
			1>			LEFT ON TRIP No.1			
			TE	17 45					
			L	18 95					
			2>			LEFT ON TRIP No.2			
			TE	23 70					
			L	25 45					
DM_S	30 00		3>			FIX FLAT TIRE			
TE	31 10		TE	31 00					
WO			L	31 55					

L—Loading Time
M—Maneuvering Time
TE—Traveling Empty
TL—Traveling Loaded
D—Discharging
WO—Waiting for Other Car
DL—Delays in Loading
HS—Handling Supplies
PC—Place Change
DM_S—Delays, Mechanical—Shuttle Car
DM_L—Delays, Mechanical—Loader
DS—Delays at Discharge
DP—Delays—Face Preparation
DN—Delays—Natural Conditions
DO—Delays, Other

FIELD FORM A. "Symbol," "Observed Continuous Time," and "Remarks" are recorded in field. "Working Time" is computed later.

SIGNIFICANT ACTIONS and delays are recorded with these 15 carefully chosen symbols applying to loader and shuttle car.

Exposes Mining Bottlenecks

are obtained from mine records. These data are used with the time and method study data to calculate ratings for production units.

Chief object of the study is to determine productive time, necessary delays, and unnecessary delays. To gather data to evaluate these items, observers must fill out standard forms in shorthand. Field Form A (see illustration) is used to record nearly everything that happens in a section, and each activity is described by an easily-learned symbol. These symbols are:

TKZ—Total Productive Time. This is the part of the shift during which a machine actually does productive work. TKZ is a summary of the five following elements:

L—Loading Time. The time consumed when the shuttle car is under the boom of the loader, receiving coal.

M—Maneuvering Time. Movement of the loading machine or shuttle car or both while at the face, which is necessary for loading. During this movement no coal is loaded.

TE—Traveling Empty. Movement of the empty shuttle car over normal travel route from the discharge station to the loading machine.

TL—Traveling Loaded. Time used by the shuttle car in traveling with a load of coal from loader to discharge station.

D—Discharge Time. Time during which discharge conveyor of shuttle car is running, transferring the load to another carrier or to a bin.

Important — The five symbols shown above do not account for any *delays* that occur while loading, maneuvering, traveling, or discharging. All delays have their own special symbols listed below. Men making the study must record each delay separately with the appropriate delay symbol.

TND—Total Necessary Delays. Time when the machine being studied is not producing, but is engaged in unproductive work, or is delayed by operations that are a necessary part of the section conditions. TND includes the following four time elements:

WO—Waiting for Other Car. The time the shuttle car is standing by waiting for other car to pass.

DL—Delays in Loading. Any delay that prevents the loader from loading while coal is available and the shuttle car is ready to receive it. Included are: timbering, testing for gas, testing roof, breaking lumps, gobbing rock, digging face.

HS—Handling Supplies. Time consumed in any shuttle-car handling and movement of supplies such as timber, rock dust, bits, tools, parts.

PC—Place Change. Time consumed in moving from one working place to another. Included are: tramming, handling cable. Note—all delays en route are recorded with appropriate symbols.

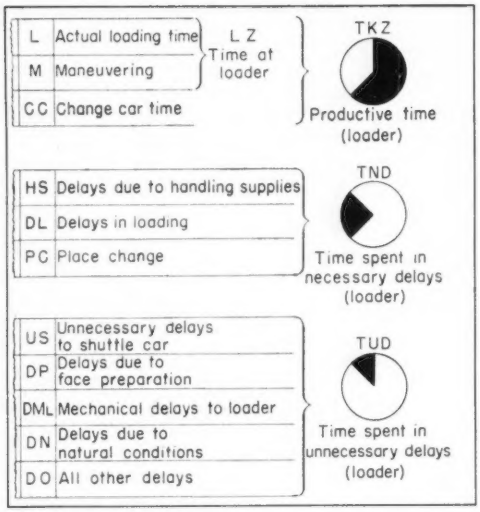
TUD—Total Unnecessary Delays. Time during which the loader or shuttle car is not engaged in production, because of delay that is considered unnecessary. TUD includes the following six time elements:

DM_S—Delays, Mechanical—Shuttle Car. Time during which the shuttle car is removed from production by a mechanical delay. Included are: battery failure; cable failure; mechanical or electrical breakdown within shuttle car; battery changing; lubrication.

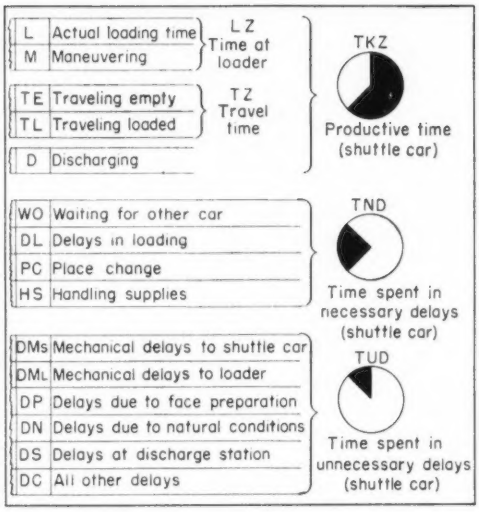
DM_L—Delays, Mechanical—Loader. Time during which the loader is unable to operate because of a mechanical failure. Included are: mechanical or electrical breakdown within loader; failure of cable; lubrication.

DS—Delays at Discharge Station. That time during which the shuttle car is ready to discharge but is prevented from doing so. Included

LOADER STUDY SHOWS THIS


L Actual loading time
M Maneuvering
LZ Time at loader
CC Change car time
TKZ
Productive time (loader)
HS Delays due to handling supplies
DL Delays in loading
PC Place change
TND
Time spent in necessary delays (loader)
US Unnecessary delays to shuttle car
DP Delays due to face preparation
DML Mechanical delays to loader
DN Delays due to natural conditions
DO All other delays
TUD
Time spent in unnecessary delays (loader)

SHUTTLE-CAR STUDY SHOWS THIS



WITH THESE SUMMARIES, management and production engineers can correct any time-consuming non-productive phase of the loading-hauling cycle. Obviously "Total Unnecessary Delays" is the item deserving most careful scrutiny.

are: belt stoppage; car spotting; no empties; belt loaded inby; failure of auxiliary discharge equipment.

DP—Delays in Face Preparation. Time consumed while the unit is delayed by the preparation crew. Included are: waiting for drilling, cutting and shooting to prepare an immediate place; shooting adjacent places.

DN—Delays—Natural Conditions. The time consumed by a delay due to bottom or roof conditions. Included are: roof falls; roadway maintenance; rough or muddy bottom; upheaval of bottom; subsidence of roof.

DO—Delays, Other. All delays not mentioned above are placed under this category. When filling out field forms, each DO item requires a note in the "Remarks" column. Included are: lunch; ventilation; other equipment failures; power failure.

Observers are instructed to record each activity of the loader or shuttle cars by writing in: (1) The proper symbol, and (2) The "observed continuous time." This is the watch reading at the *completion* of each recorded activity. "Working time" column on the forms used is left blank. Working time is computed later. Both observers start their watches at the same instant with a reading of 00.00. Watches are then allowed to run without interruption until the time study ends.

In planning a time study, observers are required to study a standard field procedure and sample field forms. Observation points are carefully selected. The precision desired in the time study is determined beforehand. A freshly posted map is obtained and studied. General information regarding the section to be studied is recorded on standard forms.

After observations have been made and recorded, the completed field study must be summed up to give useful information about section efficiency. Time-interval symbols shown below are used to condense the mass of time-study data from Form A. Data is arranged for analysis as follows:

CC—Change Car Time. Time during which the loader is ready to load but the shuttle car is absent, doing other productive work. Delays that keep the shuttle car from returning to the loader in a normal time are not counted as part of CC.

In a single shuttle car system,

$$CC = TL + D + TE$$

In a multiple-car system, true CC must be calculated by subtracting all delays that affect the normal return of the shuttle car to the loader. A summary form is used to make this task simple; CC is used in summing up loader operations.

US—Unnecessary Delays to Shuttle Cars. Total unnecessary delays preventing shuttle car from returning to loader. Such delays increase the apparent CC time but must be subtracted from it to obtain the true CC time. US includes DMs, DS, DN and DO of the study. But it includes these delays only in so far as they affect the prompt return of the shuttle car.

$$CC + HS + US = \text{Apparent CC}$$

LZ—Total Loading Time. Time during which the shuttle car and loader are in position at the face engaged in the work of loading the shuttle car. LZ is used in summing up loader and shuttle-car operations.

$$LZ = L + M$$

TZ—Travel Time. Time spent by the shuttle car traveling in the production cycle. TZ is a shuttle car summary item.

$$TZ = TL + TE$$

Total Productive Time. That part of the shift during which the machine being studied does productive work. TKZ is used to sum up both the loader study and the shuttle car study.

In the loader study,

$$TKZ = LZ + CC$$

In the shuttle car study,

$$TKZ = LZ + TZ + D$$

Total Necessary Delays. That part of the shift during which the machine being studied is not producing, but is engaged in unproductive work or is delayed by operations that are a necessary part of the section conditions. TND is a summary item for both loader and shuttle car.

In the loader study,

$$TND = HS + DL + PC$$

In the shuttle car study,

$$TND = WO + DL + PC + HS$$

Total Unnecessary Delays. That part of the shift during which the loader is not engaged in production, because of a delay that is considered unnecessary. TUD is a summary item for both loader and shuttle car.

In the loader study,

$$TUD = US + DM_L + DP + DN + DO$$

In the shuttle car study,

$$TUD = DM_S + DM_L + DP + DN + DS + DO$$

TYZ—Total Shift Time. The time that is spent in the section. TYZ for the loader is of course the same as TYZ for each shuttle car. But the separate time intervals that make up TYZ are different for the loader than for the shuttle cars. That is why the loader and shuttle car operations must be summed up separately.

Note—*The groupings under TND and TUD are somewhat controversial. Some delays in each group may be placed in the other, according to the individual view of mine management as to whether the delays are "necessary" or "unnecessary." The groupings given here were set up to cover many mines.*

The foregoing discussion merely outlines important features of the time-study method. Many details and illustrations of forms have been omitted, but they will be made available to interested readers as explained at the conclusion of this article.

As mentioned, the Penn State (Combined Study) Method includes a *method study* and production study also. These are described briefly as follows:

The Method Study

To obtain essential data for a method study, time-study observers also fill out Form B on the job. This lists the following information: Name of mine, section, shift, number of shifts per day, number of men in section, tonnage of shift studied, average shift tonnage for past six months, places worked, cut, stand-by positions, distance from face to discharge; and the type, age, capacity, and interval between overhauls for loaders, shuttle cars, drills, cutters, discharge, mine cars, belt, car spotter and other equipment.

A map of the section studied is obtained showing: various loading places, routes traveled by shuttle cars, stand-by points, discharge stations, cable anchorages, battery stations, ventilation doors, and main-line transportation. These conditions are also noted: travel distance, seam thickness, width of travelways, direction and percent of grade, roof and bottom conditions, timbering, and method of discharge.

Careful study of the section diagram may reveal these defects: complicated travel routes that can be simplified; right-angle turns that can be eliminated; stand-by points unnecessarily far from loaders; cable interference, especially at ventilation doors; discharge points accessible from only one side of entry; and track layouts inadequate to provide empties as needed.

Production Study

In a final step, all facts obtained are boiled down into key performance ratings which can be used to compare relative productivity of men and machines in one section with that of another, or to determine gain or loss in productivity in one section over a period of months.

A "Master Summary Form" is provided for this purpose. It includes these items obtained from time and method study data: number of men in section; tons per man-shift; ratio of shift-tons to average (Penn State records contain averages for comparable coal workings acquired from many time studies); working time of loader; tons per loader hour; average loading time per ton; number of trips; tons per shuttle car; productive use of shuttle car; average distance per round trip; average speed traveling empty; average speed traveling loaded; average discharge time per trip; average discharge time per ton; average time at loader per trip; ton-miles per shuttle-car-hour. Convenient arrows printed on the form serve as a constant reminder to indicate desired trends. Thus an arrow in the "number of trips" line points up, while an arrow in the "average loading time" line points down.

After performance has been summarized, results must be interpreted. On the basis of many studies made at Penn State, here are a few of many conclusions drawn:

Large time totals for DM_S and DM_L indicate faulty equipment, overloading, poor maintenance, or unsuitability of machines.

High DS means: primary haulage operated inefficiently; primary haulage poorly coordinated with section requirements; discharge methods poor—particularly car spotting; or poor engineering layout.

High DN means: bad mining conditions; poor roadway and roof control; lack of runaround for shuttle cars; or lack of working places for loaders.

High WO and CC means: wrong stand-by position; too lengthy hauls; or insufficient number of shuttle cars.

High PC means: slow tramming speeds or poor engineering layout.

Slow speeds mean: poor roadway maintenance; operator is inefficient; poor machine maintenance; or poor engineering layout.

The following data based on case studies by the Mineral Industries Experiment Station at Penn State College, indicate the wide range of efficiencies existing in loading and hauling operations at various mines.

In 73 cases studied, maneuvering time (M) averaged 4.83% of total shift time, but varied from 0.15% to 17.20%. High M indicates a poor operator, faulty face preparation or a bad roof.

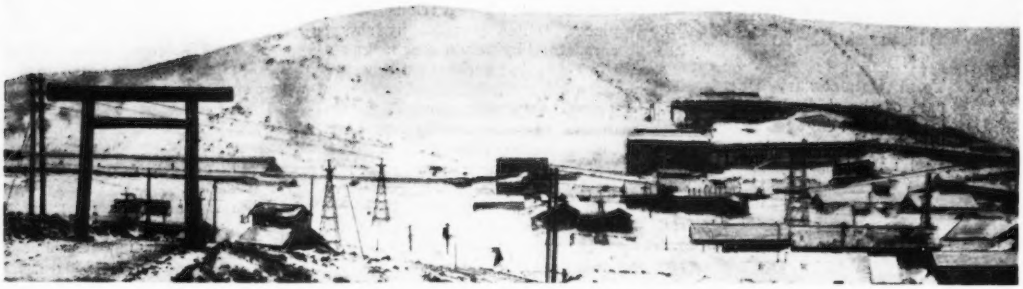
In 95 cases studied, waiting for other car (WO) averaged 12.25% of total shift time, and varied from 1.11% to 26.78%. High (W) means poor layout and poor coordination.

In 74 cases studied, place change (PC) averaged 8.59% of total shift time, and ranged from 0.30% to 21.6%. High PC means poor layout and inefficient supervision.

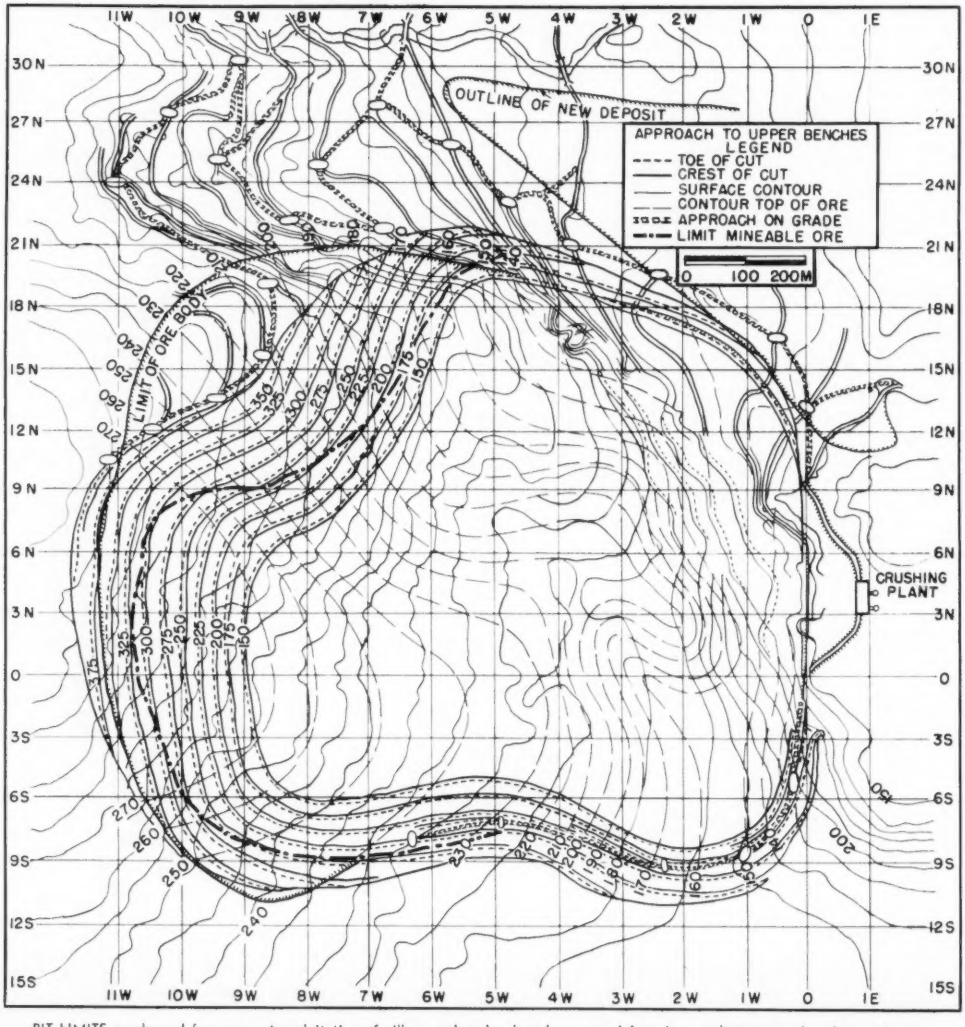
In many of the cases studied, a need for better maintenance procedure was clearly evident. Mechanical delays were caused by minor failures in shuttle cars and loaders, cable failures, and main power failures.

Bulletin Describes Method

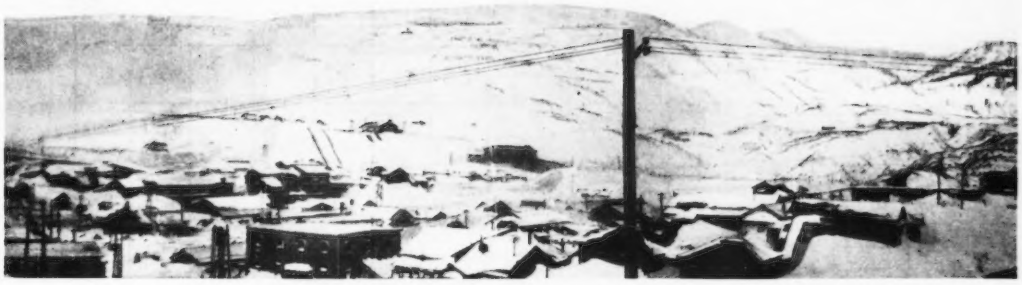
The complete explanation of this combined study method including sample copies of all forms used, a thorough analysis of causes of and remedies for time losses and inefficiencies based on numerous studies made in coal mines, and average performance ratings for numerous mine sections is now being prepared by the authors and will soon be released as Bulletin No. 50, "More Profit in Mechanical Mining," by Pennsylvania State College, Mineral Industries Experiment Station, State College, Pa. Copies of these well-illustrated books will be available about March 1 for $3.00 per single copy, and $2.50 for quantities of 10 or more.



PRESENT SURFACE PLANT AT THE MATSUO SULPHUR-MARCASITE MINE IN HONSHU.


OUTLINE OF NEW DEPOSIT
APPROACH TO UPPER BENCHES
LEGEND
TOE OF CUT
CREST OF CUT
SURFACE CONTOUR
CONTOUR TOP OF ORE
APPROACH ON GRADE
LIMIT MINEABLE ORE
0 100 200M
LIMIT OF ORE BODY
CRUSHING PLANT
11W 10W 9W 8W 7W 6W 5W 4W 3W 2W 1W 0 1E
30N 27N 24N 21N 18N 15N 12N 9N 6N 3N 0 3S 6S 9S 12S 15S

PIT LIMITS as planned for open-cut exploitation of pillars, and undeveloped ore remaining. Approach to upper benches is shown.



THE PRODUCT IS CONVEYED BY AERIAL TRAMWAYS TO RAIL AT YASHIKIDAI.

Matsuo Sulphur Mine May Become an Open Pit

A big tonnage remaining in Japan's large deposit on Honshu is estimated to be available by shovels and trucks

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Natural Resources Section
General Headquarters
Supreme Commander of the Allied
Powers, Tokyo, Japan

ONE OF JAPAN'S MAJOR mineral assets is the Matsuo sulphur-marcasite ore deposit in Iwate Prefecture of northern Honshu. This deposit rivals in size the famous Rio Tinto deposit described some time ago[1] in the *Engineering & Mining Journal*. On the completion of proposed plans for converting the present mine from underground to open-pit methods, it is expected that Matsuo will become the keystone in an expanded sulphuric acid industry, which will permit the manufacture of the additional fertilizer so necessary in the hungry Far East.

The Matsuo deposit was found in 1890 by two hunters who set fire to the rock on which they had built a fire. After several years of irregular development and mining, the present owner, Matsuo Mining Co., Ltd., was formed and started systematic development. Since then 5,000,000 tons of pyrite and 610,000 tons of refined sulphur have been shipped. The maximum annual production has been 609,800 tons of pyrite and 64,400 tons of refined sulphur. This was in 1938. Output at present is limited to 25,000 tons of pyrite and 5,000 tons of sulphur per month. The postwar difficulties of worn equipment and inadequate transportation that are experienced are responsible.

Four aerial tramways carry the ore from the crushing, screening and sulphur plant at the mine to storage bins at Yashikidai. From here it is transported in 15-ton cars over the mine railroad for seven miles to a branch of the government railroad, and then 10 miles to the north-south main line of the government railroad running between Tokyo and Aomori.

Winter Climate Limits Work

The climate of the region where the mine is situated is rigorous in winter. Fierce blizzards are numerous. This condition should limit open-pit operation to about 175 working days per year.

There are two deposits at Matsuo. These are the main developed orebody on the southwest and a smaller, explored but not mined, deposit on the northeast. The latter is probably a faulted portion of the main orebody. The main deposit is a lenticular replacement of andesite by sulphur and marcasite, locally called pyrite. It is probably late Tertiary in age. The elevation of the surface varies from 930 meters above sea level at the 148-meter main-haulage level to 1,180 meters at the east end of the mine. The portion which it is proposed to work by open-pit methods has a length of about 950 meters down the 8-deg. dip and a north-south length of 800 meters along the strike. The ore's average thickness is 117 meters, that of the overburden 75 meters.

The andesite overlying the ore is ordinarily quite hard but has been altered in the lower portion to a material resembling tuff. This is softer and contains more or less sulphur. The contact is irregular and is entirely an assay boundary. The footwall is hard and definite.

The ore itself consists of large irregular deposits of marcasite, sulphur ore and waste. Fortunately, these occur in sufficiently large masses to permit mining them separately for the most part. Average analyses show that the differentiation between sulphur and pyrite ore is arbitrary.

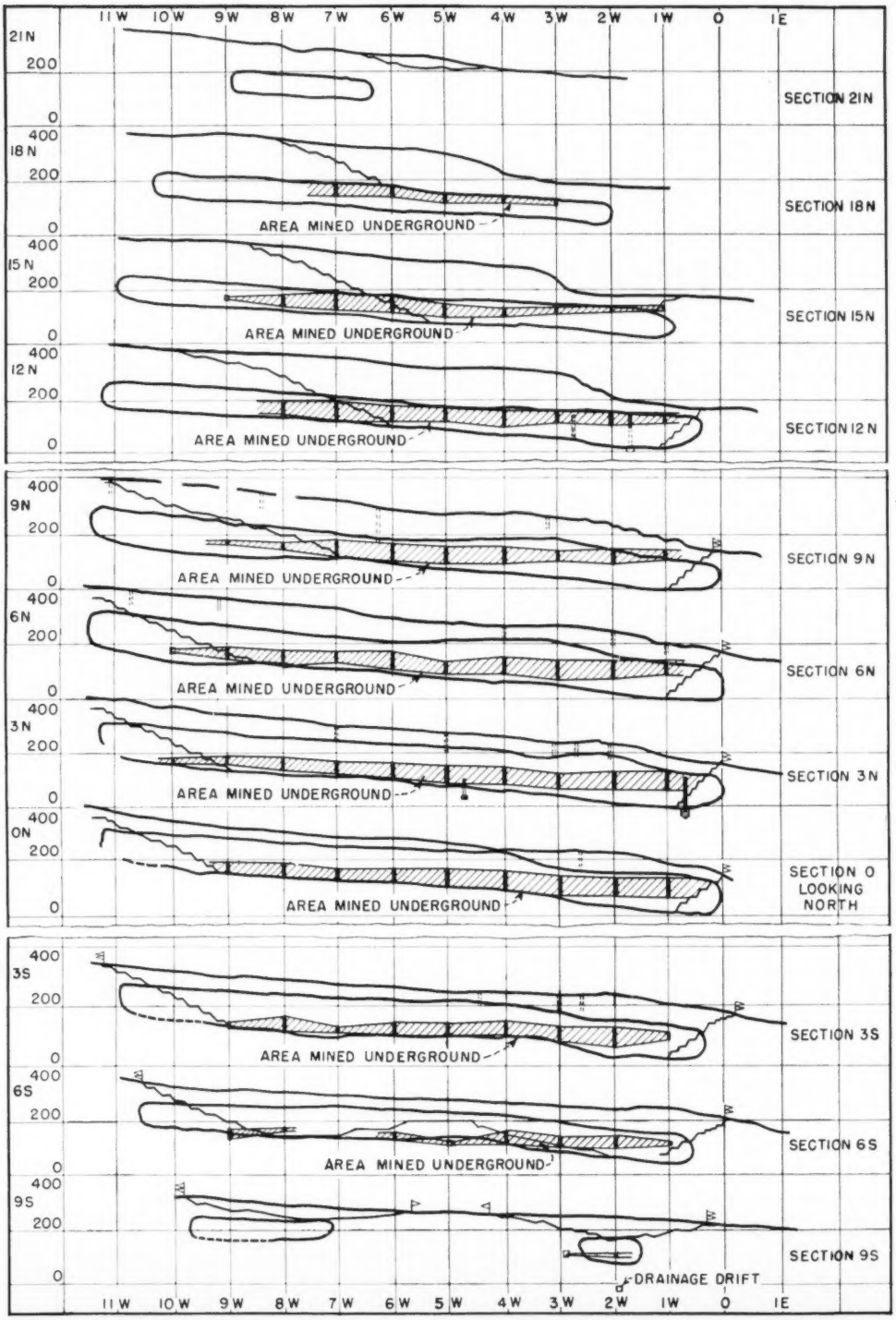
Partial Analysis of Average Ore

Chemical	Pyrite Ore	Sulphur Ore
Total S	39.00	39.00
Free S	27.00	31.50
Fe_2O_3	13.32	8.72
CaO	0.42	0.61
MgO	0.14	0.21
SiO_2	37.80	41.40

About 40% of the ore mass is too low in grade to pay for shipment

[1] "Mining in Spain's Huelva District," E&MJ, Oct., 1947, p. 90.

AREA MINED UNDERGROUND in Matsuo deposit is shown by cross sections taken at 200-meter intervals. Compare with plan.



and has largely been left in place in the past. Only about 25% of the mineable ore is treated as sulphur ore; the balance is shipped without sorting or concentration as "pyrite" ore.

The sulphur is sold to the paper, match, insecticide and medical manufacturing industries. The pyrite ore is used in the manufacture of sulphuric acid, ammonium sulphate, superphosphate and other chemicals.

The pyrite ore has a dark grey, massive appearance, with some inclusions of unaltered andesite. It is considerably harder than the altered andesite and softer than the sulphur ore. The sulphur ore has a light grey to yellowish white color. The specific gravity of both ore and andesite is 2.2. Both ores stand well without support over spans of 10 meters, but disastrous caves have occurred and have been attributed to leaching of sulphur from long-exposed pillars.

Past Mining Low-Cost

The mining methods used in the past would be considered wasteful by American standards. They have however, resulted in a large production at low cost in a country where labor has been plentiful and cheap. Main tramming levels are driven west from the surface at 12.5-meter vertical intervals through the andesite and orebody. These main entries are timbered or lined with concrete in the andesite and caved areas. Save for an occasional 4 by 4-meter timber crib, none of the drifts or openings in the mine have been timbered.

In the orebody, cross-cuts are driven north and south every 100 meters to the limits of ore. At 33-meter intervals in these crosscuts, stope drifts (room entries) are then driven east and west, parallel to the main entries. These entries are systematically sampled and, where ore is shown, stopes 10 meters wide and 6 meters high are driven by breast stoping north and south to within 5 meters of the next room entry. A 26-meter pillar is left between stopes driven from the first entry, which is split by stopes driven from the next entry. This leaves an 8-meter pillar at the sides and a 10-meter pillar at the ends of every stope. Care is exercised by the management to make sure that drifts and stopes are directly under similar openings on the levels above and below.

Although this method recovers only 20% of the ore blocked out, it has left all but a small caved area in a condition permitting the mining of the pillars by open-pit methods.

Drills and Tripods

Drilling in the stopes is done with tripod-mounted drifter drills. The ore is shoveled by hand into 1-ton wooden cars and is then transported to the surface by electric locomotives.

Mine waters are highly acid and would be difficult to handle by pumps. A drainage drift has been driven from a point below the lowest ore elevation in the main orebody for 2,100 meters southeast, and underground levels have been driven so that it is possible to drain all the workings through this drift.

At the surface, the pyrite ore is hand-cobbed to 10-in. size and then crushed to 1 in. in a series of crushers and screens. The final product is screened at 1 in. and the fines and oversize shipped separately.

The sulphur ore is crushed to 2-in. size in an 18 by 30-in. Blake crusher and screened at 2 in. The undersize is conveyed to the pyrite plant, crushed to 1 in. and shipped as pyrite ore. The oversize is conveyed to the melting plant. At present, this consists of 20 retorts with a capacity of 5 tons of ore eath per 24 hours in three melts. Coal is used for fuel. The sulphur is cast into molds and later broken to 6-in. size for shipment. A recovery of 80% of the free sulphur in the ore is obtained when the grade is 32%, but the recovery lowers with lowering of the grade. As shipped, the sulphur averages 99.9% sulphur.

Pillars by Open-Pit Mining

Postwar inflation of labor and supply costs, an expected increased demand for sulphur, and the imminent exhaustion of the mineable, developed underground ore has compelled the Matsuo company to study the possibilities of mining the pillars and the undeveloped ore by open-pit methods. Underground development and diamond drilling indicate that 145,000,000 metric tons of crude-ore mass can be mined by stripping 88,000,000 cubic meters of hard to medium-soft andesite. The crude ore will yield about 60,000,000 tons of marcasite ore, 26,000,000 tons of sulphur ore, (6,500,000 tons of sulphur), and require the mining of 28,000,000 cubic meters (62,000,000 tons) of waste. The overall ratio of cubic meters of overburden and waste to metric tons of ore will be 1.35 to 1.

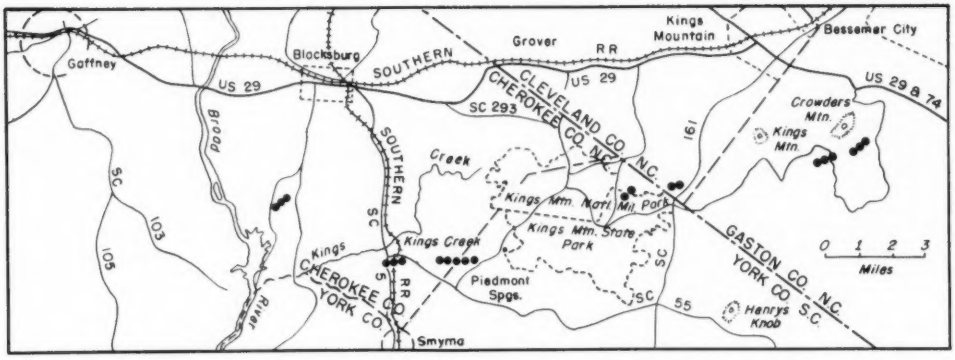
The capacity of the present railroads and tramways limits shipments to about 2,000 tons per day. Open-pit development plans are therefore designed with this initial output in mind. The plans contemplate starting operations with 2-meter electric or diesel-electric shovels; 15-ton trucks for haulage of ore, waste and stripping; churn drills for drilling blast holes, and bulldozers for use in maintaining roads, benches and dumps. It is expected there will be 21 12.5-meter levels above the 148-meter crusher level and nine levels or benches below. Although there will undoubtedly be some caving of the floor pillars from time to time, the careful location of the underground drifts and stopes will permit keeping the shovel on solid ground. While the timber cribs supporting about 9% of the stope areas will be a nuisance, the free faces of the open stopes should assist the breakage, when a drilling plan has been determined after due consideration.

Ample Dumping Facilities

Ample dumping space for the 116,000,000 cubic meters of waste and stripping is available immediately to the north of the pit for the upper benches and about one mile to the northeast for the lower levels. It is possible that the smaller orebody to the northeast can partially be mined by open-pit methods. It is not proposed to dump any material on ground where later open-pit work might be possible.

Although the annual output of the operation has not been determined, and is now limited by the transportation facilities, the mining company is giving considerable thought to the possibilities of mining a much larger tonnage than is now possible. At the same time, they would like to move the mine village and as many of the treatment operations as possible to Yashikidai, where there is space and the weather is more equable. Both objectives can be attained by driving a 4,000-ft. adit, to drain the lower orebody, from a point beneath the rail terminus, and sinking a shaft to connect with it.

While all plans conceived to date are tentative, it does appear that the Matsuo mine has an adequate orebody and for this ambitious project the possibility of becoming a successful and large producer.



SEVEN GENERAL LOCALITIES offer immediate opportunities for barite production.

New Barite Possibilities Revealed

Substantial quantities of white barite in the Kings Mountain-Gaffney area have been revealed in recent, cooperative studies by the states of North and South Carolina and the TVA. The barite occurs as veins or lenses and as disseminations in quartz-sericite schist along a belt 24 miles long. Laboratory studies indicate that the material is economically amenable to simple flotation procedure.

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BARITE DEPOSITS have been prospected and mined sporadically since the early 'eighties in the Kings Mountain-Gaffney area of North and South Carolina. They are found along an irregular belt which begins about four miles east of Kings Mountain and extends 24 miles southwest to a point southeast of Gaffney in South Carolina.

In 1947, a cooperative program of geology and ore-dressing studies was carried out jointly by the North Carolina Department of Conservation and Development, the South Carolina Research, Planning and Development Board, and the commerce department of Tennessee Valley Authority. Ore-dressing work was done at the North Carolina State College Minerals Research Laboratory at Asheville.

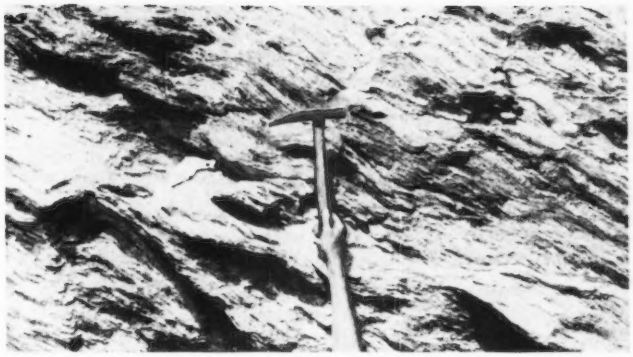
This program consisted of a geologic reconnaissance and an examination of approximately 400 barite occurrences in Gaston and Cleveland Counties, North Carolina, and in York and Cherokee Counties, South Carolina. Laboratory work included grinding and flotation tests on representative material from more than 2,000 lb. of field samples. Both the field work and the ore-dressing studies are considered to be indicative rather than exhaustive.

SURFACE ENTRY to the West Hill barite mine, situated at Kings Creek, S. C., showing the attitude of the baritic-sericite schist.

Areal Geology

The general geology of the barite belt is described in the Gaffney-Kings Mountain folio by Arthur Keith.[1] The barite occurs near the contact of two mapped formations, the Battleground schist and the Bessemer granite, both shown in the folio as being of pre-Cambrian age. The schist is described as a series of light and dark sericitic schists, manganese schist, quartzite and conglomerate. The granite is described as a strongly metamorphosed muscovite-biotite granite with zones of sericite schist. Crossing both formations nearly at right angles is a younger series of steep, narrow dikes of very dense, olivine diabase. The geologic structure is shown in the folio as a complex system of thrust faults and over-

[1] U.S.G.S., Geologic Atlas, Folio No. 222, 1931.



DETAIL of baritic-sericite schist at Kings Creek.

in the Carolinas

turned folds. The rocks have a general northwestward dip in the northern half of the area but are inclined more to the southeast near Gaffney.

Quartz-Sericite Schist

Occurrences of barite throughout the entire area are restricted to a light-colored, usually white, quartz-sericite schist. This is not like either the Battleground schist or the Bessemer granite. It conforms only roughly to the formational contact as previously mapped. This sericite schist ranges in outcrop width from a few feet to more than 1,100 ft. and is not everywhere present along the strike. An intense foliation characterizes it in all instances. Sharp contacts with other rock types are not seen. Dense silicic phases contained appear in the northern part of the area around the old Lawton barite mine, east of Kings Mountain. A fine-grained, magnetite-bearing, calcareous and siliceous rock also is found in the schist at the Kings Creek barite mines of the Clinchfield Sand & Feldspar Co. at Kings Creek, S. C. Barite occurs within the schist intermittently, as do varying, and sometimes great, quantities of white quartz. The quartz is most abundant in those localities where barite is not apparent. Besides the minerals intimately associated with the barite, important accessory minerals in the schist are feldspar, muscovite, chlorite, biotite and tourmaline.

Seven general localities within the Carolina barite belt offer immediate opportunities for barite production. They are, from northeast to southwest: The Lawton properties, on the southeast edge of Crowders Mountain, east of Kings Mountain; the "Chimney" property, two miles east of Kings Mountain Pinnacle; the Wells property, five miles south of Kings Mountain and half a mile northwest of the Cleveland-Gaston-York County corner; the White property, in Kings Mountain State Park, 1.5 miles southwest of the Wells place; the Sanders place, 1.5 miles northeast of Kings Creek, and 0.8 miles northwest of Piedmont Springs; the Kings Creek locality at Kings Creek, S. C.; the Lavender-Earl properties, 2.4 miles east of Cherokee Falls, in South Carolina. These areas average a mile in length. Smaller spot locations are known all along the 24-mile belt. Conceivably, reserves in a single locality could supply a fair size mill.

The barite deposits which have been mined previously in the Gaffney-Kings Mountain area are seemingly fissure veins and lenses ranging from several inches to more than seven feet in thickness and up to 700 ft. or more in strike length. The veins are often parallel to the major foliation of the locality (usually a northeast-southwest strike with steep, southeast dips) but it is not unusual to see large veins cutting across all apparent foliations. Locally, the barite masses appear as a system of veins which overlap and parallel one another *en echelon* along both strike and dip. Limited core drilling has revealed barite veins as much as 250 ft. vertically below the surface. Individual bodies have a tendency toward lenticular shapes when the barite exceeds two feet in thickness, but the net plunge or rake of the barite usually is zero. Contact with the wall rock is fairly distinct and a zoning of either crystal sizes or mineral content is not discernible. The barite has inclusions of sericite schist and even the purer masses contain disseminated quartz and sericite. In addition, quantities of calcite and sphalerite accompany it at the Lawton mine near Crowders Mountain in North Carolina. Magnetite and sulphides of iron and copper occur in the Kings Creek mine in South Carolina. Considerable galena is found with the barite on the Ross Starnes (Lavender) property 8 miles east of Gaffney.

A second type of occurrence has not been exploited previously or generally recognized in the Gaffney-Kings Mountain area. Recent work has shown that, in addition to the larger veins and lenses of barite, the quartz-sericite schist contains substantial quantities of barite in disseminated form. In grab samples, where barite could not be observed in the schist with the eye, the $BaSO_4$ content ranged upward from 5% at the outer limits of the schist, while the barium content increased as the locations of larger veins or lenses were approached. The barite particles vary in size from microscopic dimensions to an inch or more, and contribute to the schist a characteristic "filled" appearance similar to that of fine-grained migmatites. Accessory minerals are the same as those that occur with the barite veins and lenses, although a more intimate association between barite and quartz is probable in the disseminated type.

Mining Methods

Former methods of exploiting the Carolina barite required that mining be restricted to larger veins and lenses of comparatively pure barite. The workings were confined to shallow, surface pits or narrow drifts and wide, low rooms at limited depths underground. The ore was concentrated only by hand-cobbing and concentrates seldom exceeded 88% $BaSO_4$. This led to high-cost, low-production selective mining. By using flotation and other beneficiation procedures and handling a lower-grade ore of mixed vein and disseminated material, it is conceivable that some

form of open-pit or face-cut quarrying would solve both the cost and production elements of mining. Local topographic relief is sufficient to allow either or both mining methods. Selective mining would be done only in a general way by locating quarries in those portions of the sericite schist which were shown by core drilling to be the richer zones. Relatively shallow overburden and the weathering characteristics of the sericite schist probably would allow the recovery of barite ore from the surface on down.

Beneficiation Studies

Disregarding a variable sulphide content, and assuming a mixture of vein and disseminated barite, a beneficiation plant would be concerned with two general classes of barite ore. The first would comprise material from near the surface and would contain slimes and iron-oxide stains. The second would be relatively fresh and free from clay and iron-stained barite. Concentrates of good, white color were made from all types of bulk ore, with the iron oxide separating out with the gangue instead of passing on with the concentrates. In one sample, hand-picked to provide a heavily-stained barite feed, some form of leaching would have been required. This type represented a negligible percentage of a normal head sample. Preliminary tests on iron removal without desliming gave the results that are tabulated as follows:

Test No.	% Fe_2O_3 Heads	Type of Iron Removal	Type of Grind	% Fe_2O_3 Concentrates
17	0.27	Sulphide float	Pebble mill	0.04
27	0.27	None	Pebble mill	0.08
28	0.47	None	Pebble mill	0.19
29	0.34	None	Rod mill	0.10

The conclusion is that normal plant operations would result in a barite concentrate with an iron content low enough for standard markets and that special iron minima could be met by use of additional circuits.

Initial studies were made to determine the point of liberation of quartz from barite and the effect of various grinds on flotation results. These indicated that the barite was essentially free of gangue minerals at roughly 28 mesh. Since the ore is easily ground, and since most trades specify a minus-200 to minus-325 mesh product, it would seem economical to make this size reduction before flotation.

In viewing the over-all results of beneficiation studies of the Carolina barite ores, it is indicated that mill feeds of 20 to 45% $BaSO_4$ could be economically concentrated to a purity in the neighborhood of 95% or more, with an estimated plant recovery of better than 90%. Jigs, tables or sink-float equipment possibly could be used to improve head analyses and add to the efficiency of plant operation. The barite is inherently selective with simple grinding circuits and flotation reagents to the extent that high-grade concentrates might be produced at moderately low cost by some company willing to undertake the task.

Acknowledgment

Beneficiation studies were made by L. L. McMurray, chief engineer, and J. R. Legrand, assistant mining engineer of the North Carolina State College Minerals Research Laboratory at Asheville.

Making Observations in Boreholes

INSTRUMENTS TO MEASURE radioactivity and temperatures in boreholes have been developed by R. Guelke, J. C. R. Heydenrych and F. Anderson, scientists of the South African Council for Scientific and Industrial Research. They have been tested in boreholes in the Orange Free State, and are reported to work satisfactorily under field conditions.

As the number of boreholes completed in South Africa every year does not justify the heavy capital expenditure, such as those made on costly instruments used in United States oilfields, an instrument with a diameter of two inches was developed for local conditions. Another reason against high-cost equipment was the difficulty of handling long lengths of shielded cable in a borehole. In a 6,000-ft. hole, the weight of a cable is about a ton, requiring special power to handle it.

A very light wire with a thin covering of insulating material was decided upon. Because of its lightness this was not damaged by normal use. Also, because of the simplicity of the wire (0.036 in. steel wire covered by tough rubber 0.036 in. thick), it was also inexpensive and could be discarded after being used once or twice without increasing the cost of a measurement unduly.

In this single wire, the return circuit, has to go through the casing (or through earth). The intensity of any signal sent by the wire will therefore vary considerably. The information is sent up in such a form that wide variations in intensity do not affect the result, this being achieved by using an audio-frequency carrier which is modulated by the information required.

In the temperature-measuring instrument, the frequency of the carrier is controlled by the temperature by varying the tension on a steel wire which controls the frequency of the oscillator. At the top, a measurement of this frequency gives an indication of the temperature of the instrument in the borehole. To facilitate this measurement, a frequency-changing stage is used to reduce the frequency to a value which can be measured readily on a Reed frequency meter.

In the radioactivity measuring instrument, an audio carrier of a frequency of 6,000 cycles a second is modulated by the pulses from a Geiger-Müller counter. Each count modulates the carrier to zero for a period of about 20 cycles. The receiver at the top then rectifies the signal and, after amplification, actuates a conventional type of mechanical counter.

The scientists' chief difficulties were due to the accommodation of supply batteries in a steel tube of 1-1/16-in. internal diameter. The only HT batteries which would fit into such a small space are hearing-aid batteries, and the current which can be taken from them is limited to a maximum of five milliamperes. They succeeded in limiting the anode current required for the oscillator and the high-tension supply to the Geiger counter to 2½ milliamperes from a 67½-v. hearing-aid battery. Low-tension supply is 3 v. at 100 milliamperes.

The Geiger-Müller tubes for use in the apparatus were produced locally at the National Physical Laboratory.

TABLE I. Movements of Silver, 1931 to 1947
(In millions of fine ounces)

Country	Period	Gross acquisitions from Domestic suppliers	Gross acquisitions from Foreign suppliers	Gross acquisitions Total	Gross sales to Domestic buyers	Gross sales to Foreign buyers	Gross sales Total	Net acquisitions or net sales (—)
India	1931-47	...	...	390	...	...	444	—54
Mexico	1937-47	247	...	247	23	90	112*	135
UK	1932-47	4	192	196	62	28	90	106
USA	1931-47	2,066	754	2,820	172	411	583	2,237

*Apparent discrepancy in summation due to abbreviation of items.

Silver As Money

Monetary Fund Makes World Survey

HERBERT BRATTER
Washington, D. C.

THE INTERNATIONAL Monetary Fund has brought together considerable information concerning the monetary use of silver during recent years. This it has done in an unadvertised document called, *"Information on Silver as Submitted by Member Countries."* In coverage and treatment the document leaves much to be desired. None the less, it is the only such effort on an international scale since the U. S. Department of Commerce publication, *"The Monetary Use of Silver,"* appeared in 1933.

Mexico Pushes Survey

At the Bretton Woods Conference in 1944 efforts, under Mexican leadership, to obtain wider international recognition for silver as a monetary material were put off with a vague resolution. At the Washington meeting of the Fund's governors in 1946, a more specific resolution pushed by the Mexicans was adopted. It called upon the Fund without specified time limit to "gather whatever material is available on the monetary uses of silver; the real function of silver coins; risks and uncertainties of its monetary uses; possibilities of cooperation in the use of silver for monetary purposes, et cetera."

The Fund appears not to have taken the 1946 resolution very seriously, for at the next governors' meeting at London in September, 1947, another resolution was adopted. This one attributed the Fund's inactivity on silver to organizational and other urgent problems, and called upon the executive directors to request urgently from member countries information pursuant to the 1946 resolution and directed the Fund to make these data public not later than March 1, 1948.

The Fund, however, did not do this. Information was slow in coming in, but by Aug. 6, 1948, the Fund had the facts and had distributed them to members in time for the 1948 governors' meeting in September. That silver was not formally discussed in that meeting, so far as the public records show, is attributed to the fact that the resolutions' chief sponsor, Mexico, had its hands full with the problem of the peso exchange rate.

The Fund's document, *"Information on Silver,"* is based on a questionnaire sent to member countries on November 26, 1947. It contains no information about the use of silver in non-member countries such as Sweden, Switzerland, Portugal, the USSR, Japan, etc. Nor is the survey complete for the member countries circularized by the Fund, which impairs its utility. Of 39 members that replied to the questionnaire, five supplied no monetary data at all. These were Brazil, Egypt, Lebanon, South Africa, and (very important as a one-time silver country) China.

The Fund has collated statistics on its members' gross and net acquisitions and sales of silver 1931-47, government and central-bank stocks of silver and the amount of silver in monetary circulation during the same period, withdrawals from circulation and the amount remaining in circulation in 1947. Also the Fund has compiled regulations pertaining to silver, including monetary regulations, tariffs on exports or imports of silver, quantitative restrictions, exchange controls affecting silver movements, price control of silver, and international agreements concerning silver.

Movements of Silver

On acquisitions and sales of silver by member governments and central banks, the Fund's data do not in many cases cover the full period 1931-47. Thus, while the table on this subject lists 30 countries and one colony, in only 21 cases do the figures go back as far as 1931. This gives an idea of the unevenness of the survey. Of the 30 countries just mentioned, 11 showed no acquisitions or sales of silver during the period covered. In "gross acquisitions," including American lend-lease silver, the dominant countries during the 17-year period were the United States, India, Mexico and the United Kingdom. India was also a heavy seller during the period as a whole, as shown by Table I.

Apart from the foregoing, the reports to the Fund show that there were net acquisitions of silver by official agencies as follows: Australia (1931-47) 62 million ounces; Belgium (1933-47) 11, Canada (1931-46) 26; Colombia (1931-47) 5; Ethiopia (1942-47) 7; Netherlands (1931-47) 55; Turkey (1931-47) 10; Venezuela (1945-47) 3; Yugoslavia (1934-40 and 1945-47) 1.5, and Syria a negligible amount. Iran sold on net balance (1942-47) 20 million ounces and El Salvador (1931-47) 4 million ounces.

Most of the official purchases, outside of the United States, were for coinage rather than for monetary reserves. When a government puts silver into circulation, it is the equivalent of the sale of such silver to the public. If the face value of the silver so issued, whether in the form of coin or silver certificates, exceeds the cost of the silver, the operation yields a profit. Often the government's seigniorage is an inducement to the issuance of subsidiary or other silver coins.

Stocks of Silver

The United States' acquisition of 2,237,000,000 oz. of silver during the period 1931-47 came on top of an already considerable supply of monetary silver in the hands of the Treasury. During the period men-

tioned the U. S. stocks averaging 1,794,000,000 oz. were far greater than those of all other reporting countries combined. During the period 1937-47, United States official holdings of silver averaged 2,393,000,000 oz. These years, which included the war, marked net increases in the official silver stocks of the Netherlands (30 million oz.), Australia (8), Belgium (6), United Kingdom (3), etc. They saw net decreases in the stocks of Iran (42 million oz.), Mexico (22), Canada (8), France (6), Colombia (2), etc.

Coinage of Silver

The Fund has assembled data on silver coins in circulation for 33 member countries and six nonmetropolitan territories. It reports: "It is difficult to draw significant conclusions for the period 1931-47 as a whole because the data submitted by individual member countries in many cases cover only a part of the entire period... In approximately half of the reporting countries, the quantity of silver contained in silver coins in circulation has tended to increase in the periods covered, while in the remaining half there has been a tendency in the opposite direction."

India excepted, increases in circulating silver occurred in those countries where coinage silver was high to begin with.

Increases took place in the United States, United Kingdom, and Mexico, which apart from India, account for the great majority of silver coins in use both in 1937 and 1947. In the United States estimated silver in circulating coins increased from 224,000,000 oz. in 1931 to 749,000,000 in 1947. This reflects the increase in the demand for money brought about by the war and the attendant inflation.

The same causes have been at work in the United Kingdom, where with the aid of lend-lease silver, the amount of that metal estimated as in circulation in coins increased from 101,000,000 to 215,000,000 oz. during the same years.

During the years 1939 to 1947 the corresponding increase in Mexico was from 101,000,000 to 177,000,000 oz., reflecting not only the inflation but also the fact that in that leading silver-mining country, a very silver-conscious government saw an opportunity for seigniorage income.

The Fund's data on India's silver coins unfortunately are incomplete, but the diminishing monetary use of the white metal in that once great "silver-using" country is quite clear from the Fund's study.

The prevalence of managed currencies and the wartime and postwar inflations around the world are reflected in the replies to the Fund's questionnaire. For a large number of countries the Fund has compiled the ratio of the total value (presumably face value) of silver coins in circulation to all coins and "substitute" paper currency. Substitute paper currency is somewhat vaguely defined by the Fund researchers as "note issues of low denomination which have in effect replaced coins of equivalent face value."

This ratio has shown a declining tendency "more or less continuously during the entire period," although in some cases it has fluctuated sharply. Among the world's large users of subsidiary silver coins, the United States alone reveals an increase in the ratio from 72% in 1931 to 76% during 1945-47. For India the ratio is not available.

In a list of 25 countries and colonies between 1939 and 1947 there was an aggregate increase in the use of silver coins in circulation of 335,000,000 fine oz. The United States alone accounted for an increase of 454,000,000 oz. as employment became "full," workers migrated and prices zoomed. United Kingdom silver circulation similarly increased by 88,000,000 oz. and that of Australia by 50,000,000; but the withdrawal from India's circulation of 256,000,000 oz. and of additional amounts from other countries' circulation brought the overall total below the U.S.A.'s increase.

Coins Debased

As noted above, a good many countries have been replacing silver coins with small-denomination notes. Also there has been evident in various parts of the world a tendency to debase the silver coins by increasing the proportion of alloy.

A tabulation of withdrawal of silver coins from circulation, covering 39 countries and colonies, shows that between 1931 and 1947 in 14 countries there were no withdrawals, but in Costa Rica, Denmark and Norway silver coinage had been discarded before 1931. Of the other 22 countries, nine either discontinued entirely the use of silver coins during 1931-47 or expressed the intention to do so. The nine are: Belgium, Brazil, Chile, China, France, Greece, Peru, the United Kingdom and Yugoslavia. Whether India should be added to the list of nine, the Fund is not certain. The British Coinage Act of 1946 calls for the gradual replacement of silver by cupro-nickel coinage.

Shortcomings Cited

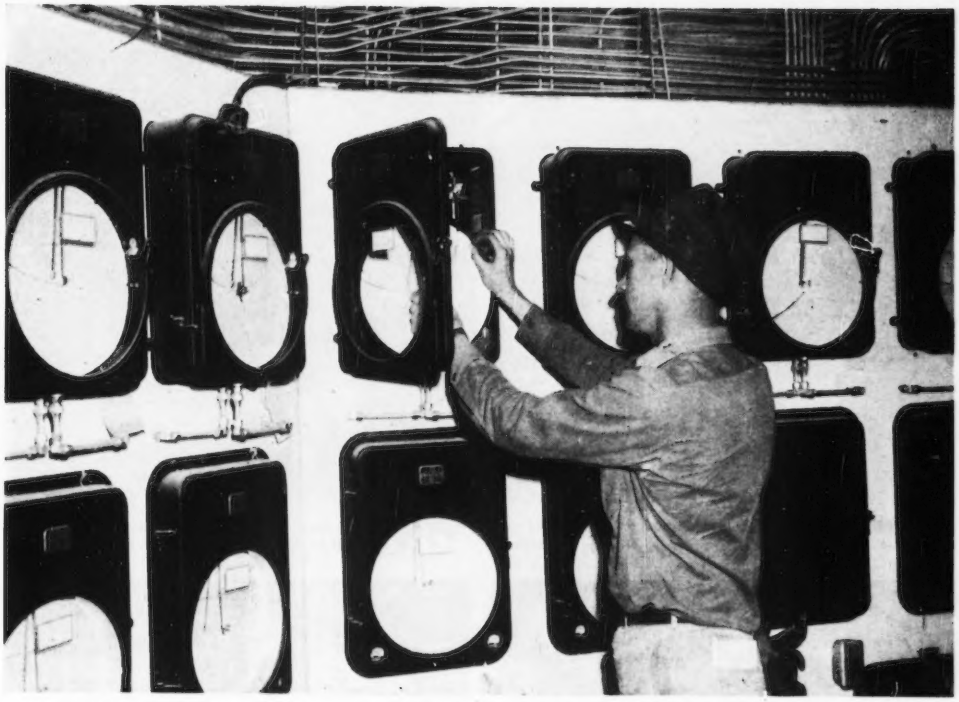
It is to be regretted that the Fund did not succeed in obtaining full replies to its inquiry from all of its members. The compilation would also have benefited by the inclusion of interpretive discussion, instead of the bare presentation of the replies. The document's accuracy may also be questioned, to judge by the information on the United States, which in one case states erroneously that no silver certificates were issued in acquiring newly-mined silver under the program of the 1930's. In another instance it gives misinformation about the certificates the Treasury issued for war-debt silver.

Most surprising of all is the statement in this Fund document which says that, inasmuch as the data submitted by the United States in response to the questionnaire were "voluminous," the information given by the Fund on the United States monetary regulations affecting silver were taken by the Fund from a book by a private citizen. The book mentioned was published in 1939, whereas the Fund document purports to describe the situation as of 1948.

The Fund carefully draws no conclusions in its "Information on Silver," apart from the observation here and there that the assembled facts make generalization impossible. Gathering these facts was of course a first step in carrying out the governors' resolutions, but there is in this document nothing to show that the Fund has gone any farther.

While this neglect may not be pleasing to Mexico, it doubtless reflects the attitude of the majority of the Fund's member countries that silver does not merit the attention Mexico wants given that metal. It is significant that not even all Latin American members had replied to the questionnaire up to the date of its publication.

Mexico has not given up hope of calling an international conference of nations interested in silver, but with the results of the Fund's inquiry falling so far short of what Mexico clearly hoped for in pushing the governors' resolution of 1946, the excuse for such a meeting is lacking.



CONTROL CENTER in plant for purifying resin taken from Utah coal. Don Kimball, asst. superintendent, changes meter card.

Making Resin From Coal

Metal Mining Company Develops Profitable Sideline

ERNEST KLEPETKO

ERNEST KLEPETKO
Metallurgical Manager
Combined Metals Reduction Co.
Stockton, Utah

THROUGH A COMBINATION of ingenuity, adaptability and sheer force of circumstances, the Combined Metals Reduction Co., Stockton, Utah, finds itself producing refined resin, a material now much in demand for preparing dielectric adhesives, varnishes, printing inks, rubber cements and synthetic materials of various kinds.

The resin comes from the bituminous coal mined by U. S. Fuel Co. at its Hiawatha mine near Price, Utah. It occurs in fractures in the coal beds up to $\frac{3}{8}$ in. thick. Through a long series of tests begun some years ago by the late W. D. Green, concentration engineer for Combined Metals, the company has learned how to recover this resin from the coal by a flotation technique.[1]

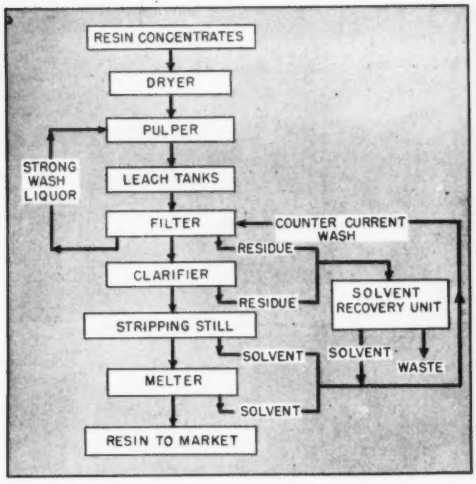
The original intention was to prepare only a resin concentrate to be shipped East for refining, but it soon became apparent that if the venture were to be successful, Combined Metals would have to do the refining of the resin as well. The technique now used is shown in the following discussion and the accompanying photographs.

Treating the Resin

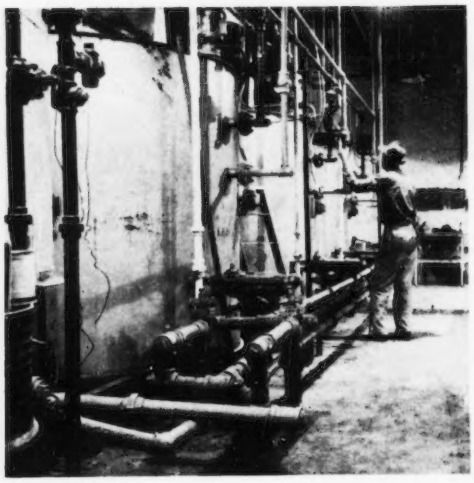
Actually, only the simplest kind of flotation technique is now being used to keep the refining plant sup-

[1] See "Recovery of Resin from Utah Coal." By Ernest Klepetko. *A. I. M. E. Tech. Pub.* No. 2166, March, 1947.

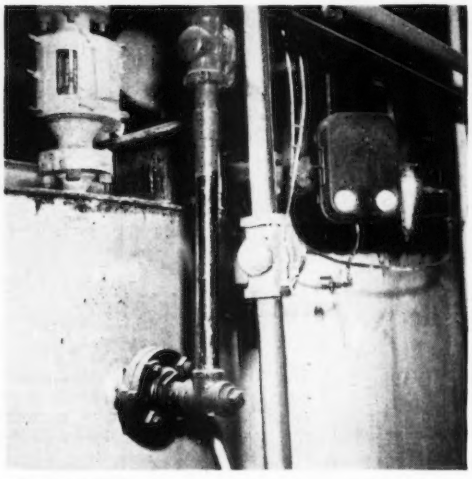
Combined Metals Reduction Company's Resin Plant *(Continued)*



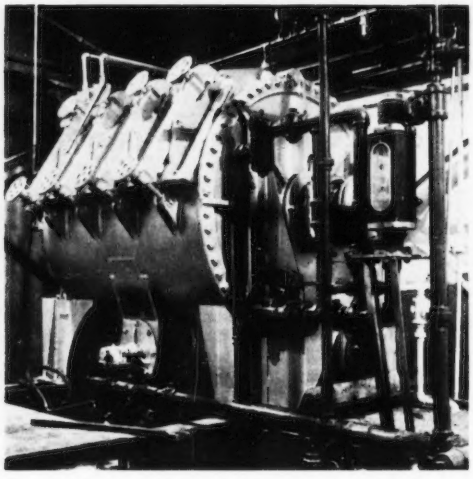
FLOWSHEET of resin plant includes leaching with hexane solvent, removal of impurities, separation of resin, recovery of hexane.



IN LEACH TANKS, hexane dissolves resin, leaves a mud composed of fine coal and insoluble resins. Job is a batch operation.



SAFETY DEVICES on leach tanks include flame arrester (left), and liquid level control (right). Safety is paramount in plant.



RESIN-BEARING LIQUOR is filtered away from mud in this special, high-pressure Conkey leaf filter. Fresh hexane washes out mud.

plied with resin concentrate. Adding a little reagent and a little air to the coal slurry feed of a Hydroseparator in the Hiawatha washing plant brings up a concentrate carrying 60% resin. This is skimmed from the surface by a drag belt.

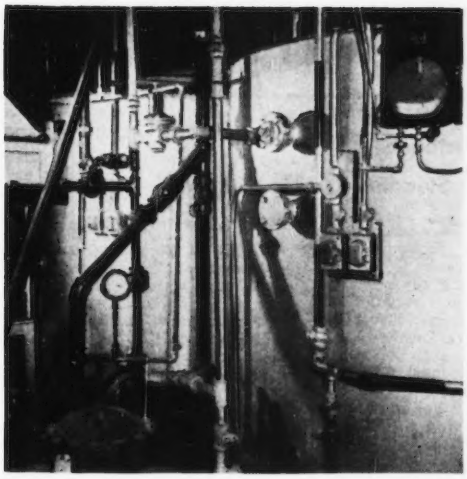
This concentrate goes to the refinery at the Bauer plant, where the resin is: 1, dried; 2, leached with hexane; 3, filtered; 4, evaporated; 5, melted; 6, cast for shipment.

On arrival at the refinery, the wet concentrate is pulped and pumped up to a twin-leaf filter that discharges directly into a McDougal hearth-type dryer. This seemed the easiest way of handling the moist adhesive material.

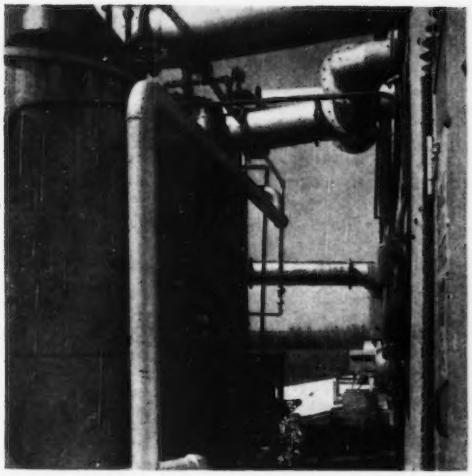
The dryer's hearths are heated by steam, both because excessive heat would melt the resin and because direct heat cannot safely be applied to so inflammable a material. Liberated moisture is exhausted by a fan through a cyclone. Fresh air enters through ports on each hearth, and the cross-flow of air to the exhauster side keeps dusting to a minimum.

Dried to less than 5% moisture, the concentrate is elevated by a belt drag and is screened to remove tramp material. It then drops into a 25-ton storage bin, which is fitted with explosion-proof doors.

Delivered to a pulping tank at a controlled rate, the concentrate is mixed with a metered amount of hexane, one of the petroleum ethers. This solvent was selected from any others because of its relatively low evaporation temperature, its selectivity for desirable resins, and its ability to produce readily filterable



STEAM volatilizes hexane in these mud-washing tanks, leaves mud-water slurry. Mud floats off in skimmer tank, water returns.



CONDENSERS for collecting volatilized hexane. Resin is recovered in evaporator and special melter for shipment to consumers.

pulps. The hexane dissolves the resin during a 4-hour leaching period in one of three sealed, mechanically-agitated leaching tanks. The pregnant resin-bearing liquor is then recovered from the residual mud in a special Conkey pressure filter.

Operating at 25 lb. pressure, this filter consists of a series of segmented disks, similar to an ordinary leaf filter, which are enclosed in a horizontal pressure tank. After the entire batch from any one of the leach tanks has been filtered, excess liquor is discharged with air pressure, and the cake is washed twice by counter-current flow of wash liquors. The first liquor off becomes the leach liquor, and the second wash becomes the first wash to the next charge.

Washing the Mud

The mud on the filter leaves is washed out by back-flow of fresh hexane into a mud storage tank below the filter. Diluted with water, the mud is pumped to a second tank, where the hexane is recovered by adding live steam under thermostatic control to the mechanically agitated mass. Hexane volatilizes at about 75 deg. C., therefore the steam drives off the solvent, leaving a mud-water slurry, which flows continuously to an outside skimmer tank. The mud, consisting mostly of fine coal and insoluble resin, floats to the surface, is skimmed off, and is rejected into a pond.

The dirty water, still hot, goes back into the boiling-off tank to pick up more mud. Discharge from the boiling-off tank is through a submerged pipe, and therefore no hexane can escape into the atmosphere. The whole mud-washing process is a continuous one.

Evaporation

Pregnant liquor from the filter is clarified, then evaporated in a standard vertical tube-type evaporator, operating at atmospheric pressure and heated by low-pressure steam. Both the liquor feed and the addition of steam are controlled automatically. Flow is continuous.

Temperature in the evaporator liquor runs about 60 to 70 deg. C., which serves to drive off at least 65% of the contained hexane. The evaporated liquor, which has a specific gravity of 0.82, flows to a sealed horizontal electric melting tank, which operates continuously.

This melting tank has six agitators and is heated by immersion-type electric elements. Half of these elements are controlled by a single manually-operated switch; the remaining quarters are controlled individually by thermostats. The aim is to hold the melted material to a temperature of about 225 deg. C.

When the thick liquor from the evaporator flows into the hot melter, the hexane flashes off as a gas, releasing the contained resin. The agitators immediately fold this dry resin into the molten bath. This strong agitation also serves to prevent formation of hot spots, or actual burning of resin, around the heating elements. Because feed to the melter is continuous, the molten resin discharges continuously through a submerged and sealed opening into the steel drums in which it is shipped.

Because the entire operation, from leaching on, is performed in closed containers, the resin cannot be contaminated and a high degree of purity is obtained.

Safety Features

The entire plant equipment is inter-connected with breather pipes provided with flame arresters, which deliver any gas emanations to a refrigerated condensing unit. Hexane obtained from the mud-washing unit, from the evaporator, and from the melter is condensed individually in three separate water-cooled condensing systems.

The plant building is of steel construction, lined inside and out with Transite. To avoid a fire hazard, whereby a man might be trapped on either floor of the building, three stairs, placed outside the building, connect the lower and upper floors and there are no inside openings between floors. Each floor has four independent ventilating units exhausting continuously off the floor to the outside, three of which are ample to give perfect ventilation.

All electrical equipment is explosion-proof, and all control equipment is air-operated.

MARKETS—Trends and Prices

Copper Supply Restricted as Utah Strike Continues—Tension in Lead Moderates—Foreign Silver Steadies

DEMAND FOR MAJOR non-ferrous metals continued active throughout December, reflecting full confidence by consumers in the business outlook for the early months of 1949. Though talk of higher prices subsided, largely because producers felt that output of metals now in tight supply could not be stepped up until strikes at important properties in this country are settled, the undertone of the market was quite firm as the year ended.

A note of caution was sounded when scrap merchants, who are extremely sensitive to possible changes in marketing conditions, offered scrap copper and lead more freely at approximately normal differentials instead of rising prices. Also, sellers of primary metals obtained from various foreign sources encountered sales resistance if higher than domestic prices were asked. However, a return to more normal trading conditions would be welcomed by all concerned. As December ended, stocks of copper, lead, and zinc in the hands of producers were abnormally low and it was felt that substantial tonnages could be added to the visible supply without affecting the price situation.

The *E. & M. J.* index of non-ferrous metal prices for December advanced slightly to 185.52, which compares with 185.26 a month previous and 152.48 a year ago. A higher monthly average for zinc more than offset the decline that took place in foreign silver.

The voluntary stockpiling program for copper, lead, and zinc is moving along about on schedule and officials of the Munitions Board now believe that the goals set for the current fiscal year can be attained without further delay. Stockpiling is still viewed as a hardship to industry, injecting strong inflationary pressures on prices.

Copper Supply Reduced

Again interest in copper centered in the strike situation at Kennecott's Utah property. As December ended the work stoppage was in its tenth week and in this period some 50,000 tons of copper have been lost so far as the market is concerned. Stockpile demands added to the troubles of the industry. Some consumers reported that their operations had to be reduced during December because of inability to obtain sufficient copper. Important producers regard the supply situation as abnormal and decidedly critical and under these circumstances they discouraged any talk of a possible rise in the price above the 23½c. basis. At times the market appeared to be on the verge of rising sharply, but the approach of the holiday season and year-end inventory problems kept prices on an even keel.

As December ended it was estimated that domestic consumers may not obtain 100,000 tons of copper during the last month of the year, owing to the shortage in supplies. During November the deliveries amounted to 100,055 tons, limited because of transportation difficulties, now ended, and work stoppages. In the Jan.-Nov. period of 1948 the deliveries to domestic consumers averaged 112,959 tons a month. A summary of the Copper Institute's figures for October and November, in tons, follows:

UNITED STATES

	Oct.	Nov.
Production:		
Crude	73,454	51,088
Secondary	8,020	7,063
Refined	101,580	102,779
Deliveries, refined	112,580	100,055
Stocks, refined	76,371	89,756

OUTSIDE UNITED STATES

	Oct.	Nov.
Production:		
Crude	108,900	108,104
Secondary	574	597
Refined	90,836	93,801
Deliveries, refined	73,298	72,606
Stocks, refined	157,894	167,928

Foreign producers of semi-fabricated copper products offered their wares in the United States market, a strange development in view of the reported scarcity of the products made of copper that exists in most parts of the world. The offerings originated in Chile and India. Authorities here were puzzled over this development which was interpreted as (1) pointing to an over-supply of copper products for the respective home markets, or (2) a conscious effort to get into the more profitable export market. In reference to the Chilean product, it was stated that some 20,000 tons could be purchased, all in semi-fabricated form. Chilean fabricating plants are not permitted to export copper in its raw state. Moreover, they can only obtain copper from important Chilean producers by paying for the metal in dollars.

Tension in Lead Eases

In spite of stockpiling, consumers showed signs of taking a more rational view of supply prospects in lead. The scramble to obtain the metal at any old price, so much in evidence in recent months, subsided. In fact, those importers who in the past took full advantage of the premium market, found that buyers now are more choosy and no longer in the mood to bid for such metal. Attempts to interest consumers in long-term contracts at fancy prices also failed. However, domestic producers report that they still have a ready market for all of the lead that they care to sell, with virtually no opposition to the 21½c. selling basis.

Production of refined lead in the United States during November totaled 47,029 tons, against 46,787 tons in October and 37,105 tons in September. Most recent import statistics reveal that 26,883 tons of pig lead arrived in the United States during October, with all indicators pointing to continued large receipts from abroad in the last two months of 1948. The recovery that has taken place in domestic output, plus large imports, has eased the tension in lead to the extent that scrap dealers have been freer sellers.

Zinc Firm at 17½c.

The slab zinc statistics of the American Zinc Institute placed total shipments for November at 96,142 tons, against 67,402 tons in October. This sharp increase resulted from the transfer of 26,295 tons to "Government account." The move was referred to as an adjustment in that the quantity shipped represented metal owned by Metals Reserve and now earmarked for the stockpile. Stocks of zinc at the end of November dropped to 19,484

Yearly Average Prices—1944-1948

(E. & M. J. Averages)

	1944	1945	1946	1947	1948
Copper, domestic, f.o.b. refinery	11.775	11.775	13.820	20.958	22.038
Copper, export, f.o.b. refinery	11.700	11.700	14.791	21.624	22.348
Lead, common, New York	6.500	6.500	8.109	14.673	18.043
Lead, common, St. Louis	6.350	6.350	7.957	14.470	17.843
Zinc, Prime Western, St. Louis	8.250	8.250	8.726	10.500	13.589
Tin, Straits, New York	52.000	52.000	54.544	77.949	99.250
Silver, foreign, New York	44.750	51.928	80.151	71.820	74.361
Quicksilver (per flask 76-lb.)	$118.358	$134.889	$98.241	$83.742	$76.489
Antimony, domestic, New York	15.839	15.839	17.306	34.852	38.168
Platinum, refined	$35.000	$35.000	$57.199	$59.087	$86.252
Cadmium (producers' quotation)	90.000	90.000	109.022	171.780	182.554
Aluminum, 99 plus percent, ingot	15.000	15.000	15.000	15.000	15.733
Magnesium, ingot	20.500	20.500	20.500	20.500	20.500

MARKETS—Trends and Prices

tons. Production of slab zinc in November amounted to 71,195 tons, against 70,716 tons a month previous.

Consumption of zinc in this country has held up remarkably well. Galvanizers of late have been relatively more active than other consumers. In fact, galvanizers have been taking fair tonnages of grades other than Prime Western to make up for deficiencies in the common grade. The price situation remained firm on the basis of 17½c., East St. Louis. In the export market 18c., f.a.s. Gulf ports, was paid.

Aluminum Output Down

The power shortage accounted for the reduction in output of virgin aluminum that occurred in November. Preliminary estimates placed output in November at 101,391,093 lb., which compares with 108,053,311 lb. in October. According to producers, the demand for aluminum is expected to exceed the supply in the first quarter.

Foreign silver was maintained at 70c. an ounce, New York, throughout the month of December, owing in part to purchases of surplus production in Mexico by the Bank of Mexico for coinage. This support steadied the market in all quarters.

The rumor of a rise in the European market for quicksilver proved correct. However, the advance announced by the Spanish-Italian group was far greater than anticipated. On Dec. 21 it was announced in New York that the International Quicksilver Corp. has been formed here to deal in the metal in the American market. At the same time it was stated that the new selling basis by the Cartel has been advanced to $70 per flask, ex European ports, or $14 higher than the previous quotation. Before the news broke, considerable business was transacted in the New York market at prices ranging from $78 to $80 per flask, duty paid. Late in the month sellers were asking from $90 to $93 per flask, duty paid, New York.

Consumers believe that more tin will be released during 1949 than in 1948, unless production in the Far East meets with a setback due to political complications.

Major Metals

U. S. DAILY AND AVERAGE PRICES

1948 Dec.	Electrolytic Copper (a) Domestic	(b) Export	Straits Tin New York	Lead New York	Lead St. Louis	Zinc East St. Louis
1	23.200	23.425	103.000	21.500	21.300	17.500
2	23.200	23.425	103.000	21.500	21.300	17.500
3	23.200	23.425	103.000	21.500	21.300	17.500
4	No Market	23.425	103.000	21.500	21.300	17.500
6	23.200	23.425	103.000	21.500	21.300	17.500
7	23.200	23.425	103.000	21.500	21.300	17.500
8	23.200	23.425	103.000	21.500	21.300	17.500
9	23.200	23.600	103.000	21.500	21.300	17.500
10	23.200	23.425	103.000	21.500	21.300	17.500
11	No Market	23.425	103.000	21.500	21.300	17.500
13	23.200	23.425	103.000	21.500	21.300	17.500
14	23.200	23.425	103.000	21.500	21.300	17.500
15	23.200	23.425	103.000	21.500	21.300	17.500
16	23.200	23.625	103.000	21.500	21.300	17.500
17	23.200	23.800	103.000	21.500	21.300	17.500
18	No Market	23.425	103.000	21.500	21.300	17.500
20	23.200	23.425	103.000	21.500	21.300	17.500
21	23.200	23.425	103.000	21.500	21.300	17.500
22	23.200	23.425	103.000	21.500	21.300	17.500
23	23.200	23.425	103.000	21.500	21.300	17.500
24	23.200	23.425	103.000	21.500	21.300	17.500
25	Holiday	Holiday	Holiday	Holiday	Holiday	Holiday
27	23.200	23.425	103.000	21.500	21.300	17.500
28	23.200	23.425	103.000	21.500	21.300	17.500
29	23.200	23.425	103.000	21.500	21.300	17.500
30	23.200	23.425	103.000	21.500	21.300	17.500
31	23.200	23.425	103.000	21.500	21.300	17.500
AVERAGES FOR MONTH						
Dec.	23.200	23.454	103.000	21.500	21.300	17.500
AVERAGES FOR WEEK						
Dec.						
1	23.200	23.425	103.000	21.500	21.300	17.500
8	23.200	23.425	103.000	21.500	21.300	17.500
15	23.200	23.454	103.000	21.500	21.300	17.500
22	23.200	23.521	103.000	21.500	21.300	17.500
29	23.200	23.425	103.000	21.500	21.300	17.500
CALENDAR WEEK AVERAGES						
Dec.						
4	23.200	23.425	103.000	21.500	21.300	17.500
11	23.200	23.454	103.000	21.500	21.300	17.500
18	23.200	23.521	103.000	21.500	21.300	17.500
25	23.200	23.425	103.000	21.500	21.300	17.500

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

1948 Dec.	Sterling Exchange "Checks"	Silver (c) New York	Silver London	Gold London	Gold (d) United States
1	402.750	70.000	42.500d.	172s. 3d.	$35.00
2	402.750	70.000	42.500d.	172s. 3d.	35.00
3	402.750	70.000	42.500d.	172s. 3d.	35.00
4	(e)	(e)	(e)	(e)	35.00
6	402.750	70.000	42.500d.	172s. 3d.	35.00
7	402.750	70.000	42.500d.	172s. 3d.	35.00
8	402.750	70.000	42.500d.	172s. 3d.	35.00
9	402.750	70.000	42.500d.	172s. 3d.	35.00
10	402.750	70.000	42.500d.	172s. 3d.	35.00
11	(e)	(e)	(e)	(e)	35.00
13	402.750	70.000	42.500d.	172s. 3d.	35.00
14	402.750	70.000	42.500d.	172s. 3d.	35.00
15	402.750	70.000	42.500d.	172s. 3d.	35.00
16	402.750	70.000	42.500d.	172s. 3d.	35.00
17	402.750	70.000	42.500d.	172s. 3d.	35.00
18	(e)	(e)	(e)	(e)	35.00
20	402.750	70.000	42.500d.	172s. 3d.	35.00
21	402.750	70.000	42.500d.	172s. 3d.	35.00
22	402.750	70.000	42.500d.	172s. 3d.	35.00
23	402.750	70.000	42.500d.	172s. 3d.	35.00
24	402.750	70.000	42.500d.	172s. 3d.	35.00
25	(e)	(e)	(e)	(e)	Holiday
27	402.750	70.000	Holiday	Holiday	35.00
28	402.750	70.000	42.500d.	172s. 3d.	35.00
29	402.750	70.000	42.500d.	172s. 3d.	35.00
30	402.750	70.000	42.500d.	172s. 3d.	35.00
31	402.750	70.000	42.500d.	172s. 3d.	35.00
AVERAGES FOR MONTH					
Dec.	402.750	70.000	42.500d.	—	$35.00
AVERAGES FOR WEEK					
Dec.					
1	402.750	70.313	—	—	
8	402.750	70.000	—	—	
15	402.750	70.000	—	—	
22	402.750	70.000	—	—	
29	402.750	70.000	—	—	

Calendar week averages: New York Silver Dec. 4th, 70.000; 11th. 70.000; 18th, 70.000; 25th, 70.000.

(e) No market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c. to 0.15c. per pound.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for the Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month; the premium on Special High Grade in most instances is 1¼c.

Quotations for lead are for common lead. Corroding lead commands a premium of 10 points.

(c) The daily New York silver quotation reported by Handy & Harman is for silver contained in ores and other unrefined silver-bearing materials, in cents and one-eighth cent fractions per troy ounce. It is determined by Handy & Harman on the basis of actual sales of bar silver .999 fine in amounts of 50,000 ounces or more for nearby delivery at New York, and is usually one-quarter cent below the price paid for such bar silver, this deduction being the allowance for carrying, delivering, and marketing. In addition to foreign silver, the quotations also apply to domestic and Treasury silver if such silver enters into the New York market.

The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

Markets—Trends and Prices

Miscellaneous Metals

(Monthly Averages)

Average prices of miscellaneous metals for November and December:

	Nov.	Dec.
Quicksilver, N. Y., flask	77.913	82.154
Antimony (a)	41.670	41.670
Antimony, bulk, Laredo	38.500	38.500
Antimony, in cases, Laredo	39.000	39.000
Antimony, Chinese (b)	.....	.....
Platinum, oz. troy	93.000	93.000
Cadmium (c)	195.652	200.000
Cadmium (d)	200.652	205.000
Cadmium (e)	205.652	210.000
Aluminum, ingot	17.000	17.000
Magnesium, ingot	20.500	20.500

(a) New York, packed in cases, in lots of 6 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

E. & M. J. Weighted Index of Non-Ferrous Metal Prices

(100 is composite for 1922-3-4. Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum)

1938	73.67	1943	88.74
1939	77.71	1944	88.74
1940	79.22	1945	90.86
1941	83.49	1946	110.06
1942	86.80	1947	149.46

	1946	1947	1948
January	96.42	140.88	154.20
February	96.42	140.42	155.63
March	96.42	150.71	155.63
April	96.42	153.14	160.67
May	96.42	154.03	161.33
June	107.16	150.05	162.30
July	117.11	148.73	164.55
August	113.32	149.35	177.68
September	113.32	150.80	178.26
October	114.25	151.05	179.58
November	131.23	151.92	185.26
December	142.19	152.48	185.52

Official London Prices

Since Dec. 18, 1939, the British Ministry of Supply has named maximum delivered prices for the major non-ferrous metals. Delivered prices for consumers in the United Kingdom as of Dec. 31, 1948:

	Per £	Long s.	Ton d.
COPPER:			
Electrolytic, high conductivity	140	0	0
Fire refined, high conductivity	140	0	0
Fire refined, high grade	139	10	0
Fire refined, min. 99.2 percent	139	0	0
Fire refined, min. 99.7	138	10	0
Hot rolled black wire rods	146	0	0
LEAD:			
Soft, foreign, duty paid	112	0	0
Soft, Empire	112	0	0
English refined	113	10	0
ZINC:			
Foreign (G.o.b.), duty paid	106	0	0
Domestic (G.o.b.)	106	0	0
Prime Western and debased	106	0	0
Refined and electrolytic	106	15	0
Minimum 99.99 percent	108	5	0
TIN:			
Ingot, 99 percent	569	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York unless otherwise stated

MISCELLANEOUS METALS

(Jan. 1, 1949)

Aluminum, ingot, 99 plus percent, lb. (base price)	17c.
Antimony, spot, lb., 5 tons and up but less than carload, in cases	41.67c.
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, lb.	$2.00
Calcium, lb., ton lots, 98 percent, cast	$1.95
Chromium, 97 percent grade, lb., spot	$1.02
Cobalt, 97 to 99 percent, per lb.	$1.65
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb., f.o.b. Port Colborne (a)	40c.
Magnesium, 99.8 percent, carloads, lb., producer's plant	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots), troy oz.	$93.00
Quicksilver, flask of 76 lbs., 25 flasks or more	$90.00
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	16.50c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$15.00
Titanium, 96 to 98 percent, lb.	$5.00@$6.00

(a) Includes U. S. duty.

METALLIC ORES

Beryllium Ore, 10 to 12% BeO, f.o.b. mine, per unit	$26.00@$30.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry	
48% Cr_2O_3, 2.8 to 1 ratio	$34.00@$35.00
48% Cr_2O_3, 3 to 1 ratio	$38.00@$41.50
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$6.60
Mesabi bessemer	$6.35
Old Range non-bessemer	$6.45
Mesabi, non-bessemer	$6.20
Lead (Galena), 80 percent, Joplin, Mo., ton	$292.17
Manganese Ore—Per long ton unit of Mn. basis 48 percent manganese, subject to premiums and penalties, f.o.b. cars Atlantic and Gulf ports, duty paid, 70.66@72.6c. Prices nominal.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	54c.
Tantalite, 60% concentrate, per lb.	$2.00@$2.75
Tungsten Ore, per unit of WO_3:	
Foreign, 60 percent, duty paid	$24.25@$24.75
Domestic, scheelite, 60 percent and upward	$28.50
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$110.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl., carload lots, delivered	6c.
Cobalt Oxide, 70 to 71 percent, lb., ceramic grade	$1.27@$1.30
Copper Sulphate, 100 lb.	$8.10

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be	$24.50
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	18.60c.
Ferromanganese, 78 to 82 percent, gross ton, seaboard	$160.00
Ferromolybdenum, 55 to 65 percent Mo, lb. of Mo, contained	$1.10
Ferrosilicon, 50 percent, per lb. of contained Si	10.5c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.25
Ferrovanadium, per lb. of V delivered	$2.90
Silicomanganese, 1½ percent C, per lb. contracts	8.6c.
Spiegeleisen, per long ton, 19@21%	$62.00

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U. S. funds), ton:	
Crude No. 1	$960@$1,050
Crude No. 2	$492@$550
Spinning fibers	$232@$475
Shingle fibers	$95.50@$141
Paper stock	$78.50@$88
Waste	$58
Shorts	$27@$52
Vermont, f.o.b. Hyde Park:	
Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$51.00
Refuse or shorts	$25.50@$46.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.50
Bauxite, long ton:	
Domestic, crude, 50 to 52 percent (not dried)	$4.50@$5.00
Domestic, chemical, 55 to 58 percent	(a)$8.50@$9.00
Domestic, abrasive, 80 to 84 percent	$17.50@$18.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated, bulk	$8.00@$9.00
North Carolina, ceramic grade	$18@$22
Feldspar, bulk ton:	
Potash or soda feldspar, 200 mesh	$18.50
Glass spar, white, 20 mesh	$11.75@$12.50
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois,	
70 percent, all rail movement, ton	$37.00
Acid 97% concentrate, bulk, ton	$45.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b., bulk, Washington	$31
Mica — Domestic f.o.b. mines. Punch, 12 to 22c per lb. according to size and quality. Sheet, clear, 1½ x 2 inch, 70 to 75c.; 2 to 2 inch, $1.10 to $1.20; 2 x 3 inch, $1.50@$1.65; 3 x 3 inch, $1.80@$2.10; 3 x 4 inch, $2.35; 3 x 5 inch, $2.75; 4 x 6 inch, $3.50; 6 x 8 inch, $4 to $6. Wet ground, very fine, $135@$175 per ton. Bulk sales, dry ground, $40@$80 per ton. Scrap, $25 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, cif. Atlantic ports	(a)12@14c.
Sulphur, Texas, mines, long ton	$18.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

(a) Nominal.

IRON AND STEEL

Pig iron, Valley furnaces, gross ton: Basic	$46.00
Steel, f.o.b., Pittsburgh billets, net ton	$59.00
Structural shapes, 100 lb.	$3.25

NEWS OF THE INDUSTRY

Northwest Mining Association Celebrates 54th Annual Convention in Spokane

More than 660 members and guests attended the 54th annual convention of the Northwest Mining Association held in Spokane, Wash., Dec. 3-4. The four technical sessions were devoted to reports on mining developments in the Pacific Northwest; geology; mining methods; new mine and mill equipment; and tax problems.

President Rowland King opened the convention with a short address of welcome, and then asked Roger O. Oscarson, secretary, to present a report on activities of the association in 1948. During the session following brief reports on mining activities in Washington, Oregon, British Columbia, Alaska, Idaho and Montana were read by respective representatives.

Activities Reports

Sheldon F. Glover, supervisor of Division of Mines and Geology, Olympia, Wash., stated that Washington's 1948 mineral production will exceed that of 1947 and 1946, which was $33,000,000, and that 107 metallic mining properties were in active production during the year. Some 177 operations produced non-metallics or industrial minerals.

Gold, chrome and mercury mining continue in doldrums, but production of non-metallic minerals, particularly perlite and pumice, is growing, according to F. W. Libbey, director of Oregon Dept. of Geology and Mineral Resources. Dant & Russell, Inc., Portland, Ore., plans to build a $1,000,000 plant at their perlite property near Maupin.

Frank E. Woodside, manager of British Columbia and Yukon Chamber of Mines, reported increased activity in non-ferrous metal mining in British Columbia, and slight improvement in gold and silver production. A record number of prospectors were active in many districts of the province during the summer.

E. N. Patty, general manager of Gold Placers, Inc., for Alaska, said the Territory's metal production for 1948 will amount to about $14,500,000, gold accounting for $10,000,000, and platinum $1,500,000. Development of known mineral deposits has been curtailed materially by miners and prospectors being drawn to the various military construction projects now under way. He believes that the price of gold will be increased soon after the deflation cycle begins.

Idaho's copper, antimony and phosphates are about to take their place with lead, zinc, and silver as major products, said Harry W. Marsh, secretary, Idaho Mining Association, who predicted great expansion also in the chemical field.

Covering Montana activities, Carl J. Trauerman, secretary of the Mining Association of Montana, reported good progress on the Kelley shaft of Anaconda's Greater Butte Project, and an appreciable increase in the production of phosphate rock, zinc, vermiculite, copper and cement.

During the luncheon W. L. Ziegler, general manager, Pend Oreille Mines and Metals Co., gave an interesting account on the development and surface plant construction work now in progress at the Metaline Falls property and the Reeves McDonald mine across the Canadian line of Pend Oreille Mines and Metals Co. Tribute was paid to Louis P. Larsen, president of the company, who, since 1904, has worked untiringly to prove the worth of the Metaline Falls lead-zinc deposits. Mines, plants and mills at the Metaline Falls property are being enlarged to handle 2,400 tons of ore a day, and a 1,000-ton concentrator is nearing completion at the Reeves-McDonald.

S. H. Lorain and A. E. Weissenborn, U. S. Bureau of Mines and Geological Survey, respectively, told how the Bureau and the Geological Survey are constantly expanding their work to prove new mineralized districts despite curtailment of operating funds. The Bureau in the last ten years has located minerals of a gross value of $400 million at 1947 prices. Of this, ore of $290 million in commercial grade is now under development. Work in progress at the Albany, Ore., station includes production of high purity zirconium, development of an electric reduction process to produce ferro-nickel suitable for use in the manufacture of 18-8 stainless steel from nickel-iron ore available near Cle Elum, Wash., and search for a practical method to permit commercial utilization of the low-grade, high phosphorous iron ores near Scappoose, Oregon. Mr. Weissenborn described the work done by the Survey in the phosphate fields of Southeastern Idaho, Coeur d'Alenes, John Day area, Klamath Mountains District and others.

Personal observations on some Sunshine geological and exploration problems, including recent findings in the Sunshine, Chester, Yankee Girl and Silver Syndicate vein systems were presented by Raymond F. Robinson, geologist for Sunshine Mining Co., and S. K. Garrett, engineer and geologist, of Kellogg, Idaho, followed with a report on mining and geological developments in the Pine Creek area. Recent changes in the mining practice at various properties of Day Mines, Inc., were ably explained by the company's superintendent, Rollin Farmin. He mentioned the successful use of tungsten-carbide bits in hard ground and savings in powder, novel turntable for mechanical loaders, and filling empty stopes with mill tailings.

Saturday Session

The Saturday morning session was devoted to discussion of new equipment, including design and operation of the Load King dormant platform scale and the Yale Load King scale magnetrol mechanism; the Tro-Pari bore hole surveying instrument and its use in surveying diamond drill holes; ball mill grinding with centrifugal tumbling media; WKE mobile mill and latest installations; and recent advances in rock drilling and new drill equipment.

C. Girard Davidson, Assistant Secretary of the Interior, recommended revision of mining laws and tax relief if studies indicate this will expand production; appropriation of $50 million to $60 million instead of $30 million currently available to the Department, and a study of tariff problems as they affect mining.

Tax problems were discussed during the afternoon session by Maurice Cooper and Eustace LeMaster, CPA's of Spokane. Ellsworth Y. Dougherty, mining engineer for SEC in Seattle, explained the function of the mining unit of SEC, and E. C. Stephens, geologist of Anaconda Copper Mining Co., discussed the need for changes in the law and procedure regulating the patenting of mining claims. "Facts vs. Fallacies in the Petroleum Industry, with remarks on some popular misconception regarding the American oil industry," was the title of a paper read by Fielding MacClaine, Spokane.

Declaration of Policy

Regarding TAXATION, the convention went on record urging revision of laws and rules to place the mining industry in a position no less favorable than other industry, recognizing that mining is a process of exhausting its known mineral deposits. It opposed VALLEY AUTHORITIES as inimical to a system of individual and states' rights.

It recommended that suspension of PROTECTIVE TARIFFS should not be for periods of more than a year, and that any extension of RECIPROCAL TRADE AGREEMENTS should provide against further weakening of the industry's competitive

position in a normal market. The convention was in favor of deferring treatment of GOVERNMENT OWNED ZINC concentrates when lack of economic smelter capacity threatens current domestic production.

The Association enthusiastically supports the BUREAU OF MINES plan to establish headquarters for a Bureau mining division in the Northwest, and the mining Experiment Station in the Spokane area.

Kennecott and Union Continue Negotiations

Representatives of Kennecott Copper Corp. and the Brotherhood of Locomotive Firemen and Enginemen met in Salt Lake City Dec. 10 in the hope of developing a basis for settlement of the strike of 311 firemen and enginemen which began Oct. 24. Over 4,000 employees of the Utah Copper division of Kennecott Copper Corp. were thrown out of work and other related operations partly strangled.

Brotherhood demands for wage increases to the same level as that paid employees operating transcontinental railroads in this area have met a cool reception from company officials. They point out that wages paid other mine employees are tied to the scale for mine enginemen. An offer by the relatively small Non-Ferrous Clerical and Technical Workers Union (independent) Nov. 19 to waive any wage increases granted the strikers did not bring similar offers of waivers from other unions.

Following a meeting Nov. 18 of some of the unions affected, Vern B. Reese, secretary of Magna-Arthur Millmen's local 392, International Union of Mine, Mill & Smelter Workers, said: "It was the unanimous opinion of those present that the request of the railroad employees now on strike is meritorious, and should be given favorable consideration by the management."

New Blast Furnace Uses Low-Grade Iron Ore

Dr. G. A. Zotos promises that his newly developed blast furnace, the first of which was installed in England a few months ago, permits use of low-grade coal and coal dust as fuel and allows direct use of inferior iron ore, including taconite. According to *New York Times*, features of the Zotos furnace are replacement of usual brick construction by the same materials produced in the furnace—thus eliminating erosion action of slags against refractory materials—and a continuous process for feeding ore into the furnace. Dr. Zotos states from 500 to 5,000 tons of pig iron daily can be produced economically in the furnace, which requires about one-third the average investment involved in constructing a blast furnace.

ATTENDING THE CONVENTION of Northwest Mining Association in Spokane were, left to right: Joseph Drumheller, president of Spokane Chamber of Commerce and president of Board of Regents, Washington Univ.; C. Girard Davidson, Assistant Secretary of the Interior, featured speaker at the Saturday luncheon; Frank N. Marr, president of Spokane-Idaho Mining Co., and Rowland King, president of the Northwest Mining Association.

New Flow in Shaft Delays Further Pumping

In crosscutting on the sixth level of the Fad shaft early this year to develop Eureka Corporation's lead-zinc orebody at Eureka, Nev., the waterflow encountered was nearly 1,000 gpm. more than available pump capacity. Subsequently the water rose to the water-table level 1,050 ft. from the shaft collar. Unwatering began in May on a carefully planned schedule, with greatly increased pumping facilities. (A full description of this operation appeared in E&MJ, Dec. 1948, p. 96.)

In November unwatering had started below the 5th level and reached a point 63 ft. above the 6th level. Here a new and increased flow of water from the bottom of the mine was tapped, which proved to be much greater than present pumping capacity. Early in December the Eureka Corporation reported that pumping would be stopped pending the results of a thorough survey, to be made by the foremost experts obtainable in North America. A preliminary estimate by the general manager of the corporation indicated that an amount exceeding $8 million would probably be required before the mine could be unwatered and ore zones opened up.

U. S. Steel Inspects Ore in Brazil, Venezuela

Accenting the effort of U. S. companies to find new sources of ore was the arrival in Rio de Janeiro Nov. 17 of Benjamin F. Fairless, president of United States Steel Co.; John C. Munson, vice president of U. S. Steel Corp. of Delaware; George A. Meckes, vice president U. S. Steel Export Co.; and John E. Hill, assistant to the president of the export company.

Mr. Fairless, who was also to visit Venezuela, was quoted in Rio as saying his company wanted to buy 300,000 tons of iron ore from the Companhia do Vale do Rio Doce in 1949, and hoped also to get at least 250,000 tons of manganese from Brazil annually. He declared, however, that unless transportation facilities were increased by Brazilians or the Brazil Government, it would be impossible to attain the quantity U. S. Steel needs. The party returned to the U. S. without announcing the closing of any deals.

Export Import Loan to Steep Rock Mines

The Export-Import Bank has made a $5 million loan to Steep Rock Iron Mines of Ontario, for further development and expansion of the mine, which is about 100 miles north of Duluth, Minn. A first mortgage on the property was given, annual installments being arranged to repay by 1960 both the new loan and the $5 million loan in 1942 by RFC. The second loan will pay the cost of equipment and engineering services involved in opening a second and larger orebody.

Annual shipments to the United States from both high-grade orebodies are expected to exceed 3 million tons. Since production started in 1945 ore shipments have amounted to more than 3.5 million tons, which was recovered from the bed of Steep Rock Lake.

WASHINGTON REFLECTIONS

McGraw-Hill Washington News Bureau

Large-Scale, Long-Range Stockpiling Agency, Or Revamped Legislative Mandate, Sought by ECA

Lack of money in the right places, inadequate long-range purchasing power, and a vague Congressional policy, is hampering ECA's job of expanding foreign production of strategic materials and increasing their flow into the United States.

Review of the situation before the new Congress is going to start a noisy fight.

Counterpart funds, local currencies set aside by the ECA countries to balance ECA grants, five percent of which can be used for purchasing surplus strategic materials for the U. S., are way out of balance. Some countries having exportable surpluses of the important commodities have no grant benefits and thus no counterpart funds. These include Sweden, Iceland, Switzerland, Portugal and Turkey.

In Belgium the counterpart funds are negligible and in China and Korea there are none earmarked for this purpose. Conversely, there are funds but no important strategic material surpluses available for sale in the Bizone area of Germany, France, Greece, Denmark, Austria or Norway. Earmarked balances are nearing exhaustion in the United Kingdom and Holland.

Stockpiling budgets for several commodities have been committed which means that some important surpluses in countries where counterpart funds are not available are not being purchased. These commodities include tungsten, rubber, antimony, sisal, cobalt, mercury, tantalite, mica and diamonds. Under the law, ECA cannot buy these wares for distribution to private industry, although word is getting around and a few may be brought in with private capital.

Foreign Output Slowed

This situation is also holding back the job of expanding foreign production. ECA officials try to encourage private enterprise by getting producers (both foreign and American) to expand with their own or "borrowed" money. But, to do this, ECA has to show the producers a long-range market. Seeing only a five-year program for stockpiling, dependent upon year-to-year financing by Congress, and no other government procurement agency, the producers are backing off from expansion suggestions. There is, to them, no promise of long-range markets in the U. S. that would allow amortization of expanded facilities.

Of course, ECA could give producing countries facilities for expansion, with no money strings tied to them, but such social pressures are contrary to the wishes of the ECA and the intent of Congress.

Thus, ECA is faced with asking Congress to give the government power and money to make long-term contracts with foreign suppliers, or "accept the realization that the aims implied in the law can only partially be fulfilled."

Naturally, what ECA will suggest is the establishment of the governmental power to make long-range procurement contracts. This program would involve delivering the foreign materials to both the military stockpile and to private industry, according to the implications of the present law as outlined at the right.

There is not, however, any formula devised which would protect American producers, their market, or their price structure.

This suggestion probably will start one of the noisiest fights that Capitol Hill has seen in a long time. First, it could put the government into the metals brokerage business in competition with domestic industry. Second, it might create enough stimulation of foreign production to eventually imperil the U. S. producer's market and price.

There are three categories of materials which could come in under an expanded governmental procurement program. They are:

Commodities now in surplus which would come in immediately, including tin, diamonds, cobalt, graphite, bauxite, mercury, tungsten and antimony.

Commodities which probably would come in after production expansion programs abroad and, initially, at least, in limited quantity: fluorspar, copper, chrome, talc, manganese, columbite, tantalite, phlogopite mica and others.

The third group of commodities which would come in after production expansion, but in unimportant quantities: lead, zinc, cadmium, beryl, iron ore and vanadium.

Minerals-states Congressmen will jump on this suggestion-interpretation with both feet, and they are powerful enough to hamper passage of any such legislation that they regard as damaging.

The fight will bring out several alternatives: first, Congress can appropriate the money necessary to provide long-range procurement; second, it can place safeguards around the distribution of any civilian stockpile to protect domestic producers; or, third, it can redesign the policies now so loosely expressed in the law.

Policy on strategic materials is expressed in four different sections of the law. It allows the administrator to provide assistance for any participating country through grants, cash, credit terms, or "on such other terms of payment as he may find appropriate," including payment by the transfer to the United States of "materials which are required by the U. S. as a result of deficiencies or potential deficiencies in its own resources."

Under the section on unilateral and multilateral agreements, the administration is told to facilitate the transfer to the U. S. by sale, exchange, barter or "otherwise," for "stockpiling or other purposes," for such period of time as may be agreed to and upon reasonable terms and in reasonable quantities, of materials (deficient or potentially so) which may be available in such participating country after due regard for reasonable requirements for domestic use and commercial export of such country.

Policy Stated

Another section of the law mandates ECA to "get something for its money" but at the same time recognize the equity in respect to the drain upon the natural resources of both the U. S. and Marshall Plan countries. The law tells ECA to negotiate: 1) "a future schedule of minimum availabilities to the U. S. for future purchase and delivery of a fair share of materials required by us, at world market prices 'so as to protect the access of U. S. industry to an equitable share of such materials either in percentages of production or in absolute quantities from the participating countries.' "

2) Negotiate an agreed schedule of increased production of such materials where practicable in such countries and for delivery of an agreed percentage of such increased production to be transferred to the U. S. on a long-term basis in consideration of assistance furnished by the ECA to such countries.

The mandate to the administrator to increase overseas production of the short or potentially short materials appears in still another section of the law.

Strict reading of the repetitive mandates in the ECA law can be interpreted to mean that there should be both a civilian and a military stockpile, which would result in an incentive to foreign producers, whose increased output would go, as the law intends, to help American industry.

Just how ECA will fare in its re-

quest for longer-range governmental purchasing power is hard to predict—but whatever the outcome the forthcoming fight promises to be an interesting one.

U. S. Geologists Wanted For British Survey Work

The British have asked ECA to provide 22 geologists and 30 geodetic surveyors for three years of service with the Colonial Geologic Survey Service. Under the proposal "first class geologists would be paid their salaries in dollars and overseas allowances in sterling." ECA is considering the proposal, and it probably will go ahead on the idea.

Inasmuch as the British specify that "only first class geologists and engineers will be acceptable," the salaries will be fairly high. Those who are recruited for the job by ECA will be able to save most of their dollar salary and live on the allowance.

Deferment of Miners Up to Local Boards

There will be no blanket deferment of miners from the draft, at least not under present conditions. An interchange of letters between Secretary of Interior J. A. Krug and Selective Service Director Lewis B. Hershey, makes this certain.

The National Minerals Advisory Council sent to Krug a memorandum, dated Sept. 24, suggesting that "during the present emergency any step which the Selective Service authority can take toward exempting miners from the draft would at least help prevent a decrease in the amount of exploration and development work accomplished."

Krug, in his letter to Hershey, pointed out the wartime experiences with manpower in the mines. He added that "as you undoubtedly know, our present stockpiling position in respect to many basic metals and minerals, is far from satisfactory. Furthermore, in some mining areas, lack of skilled manpower since the war has prevented the replenishment of underground reserves. I feel, at this stage of our stockpiling program, that efforts should be made to increase our mineral productive capacity through means that will not react adversely upon our domestic economy or our national defense structure."

Hershey's answer was "it is believed under the present law that the regulations already promulgated by the President are sufficiently flexible and make sufficient provision for the protection of the mining industry. I should like to point out that under the law only men between the ages of 19 and 26 are avaliable for service, and that veterans of World War II are exempt. The regulations also provide for the deferment of a registrant who has a wife or child—or whose induction into the armed forces would result in hardship and privation to a person dependent upon him for support."

"It will thus be seen," said Hershey, "that only a small segment of our whole population is vulnerable to service. In addition to this, provision is made in the regulations for classification in a deferred class of any registrant whose employment in industry or other occupation or employment is found to be necessary to the maintenance of the nation's health, safety or interest."

The Selective Service director explained in his letter that a registrant's employment shall be considered necessary to maintenance of national health, safety or interest when all of the following conditions exist: 1. He is, or but for a seasonal or temporary interruption would be, engaged in such an activity; 2. Cannot be replaced because of a shortage of persons with his qualifications or skill in such activity; and, 3. His removal would cause a material loss of effectiveness in such activity.

The letter did contain one tip which is of vital interest to the mining industry. Hershey said "in registering, the employee fills out a form which tells of the nature of his employment. In addition, the employer should furnish the local draft board with complete information concerning the registrant which will enable the board to make a decision as to whether or not the man qualifies as a necessary one under the regulations."

The director also pointed out that the man or his employer can take an appeal on the case if not satisfied with the classification. Appeal is made to the state appeal board within 10 days of the date of notification of classification. The decision of the state board may even be appealed to the Presidential appeal board.

"It should be emphasized that the information given to the local board by the registrant or his employer should not be just perfunctory but should be sufficiently clear to enable the local board to make a fair and just decision based on the information at hand," he said. Hershey's closing remark was that "it is believed in the light of the mining situation as outlined in your (Krug's) letter that the present regulations are adequate to handle the matter and, in view of the comparatively small numbers now being inducted into the armed forces, that industry should not be seriously hindered in its activity."

Wage-Hour Law Shift Seems Good Possibility

Management will welcome one change in labor legislation that is planned by the Truman administration and that is likely to be passed by the 81st. Congress. This is a revision of the Fair Labor Standards Act of 1938 (Wage-Hour Law) so that it includes a definition of "regular rate." This definition would eliminate the present legal requirement for so-called "overtime-on-overtime" pay under the decision last June of the U. S. Supreme Court in the Bay Ridge longshore case.

The Wage-Hour law requires employers covered by it to pay one-and-a-half times the "regular rate" of pay for any work done beyond 40 hours a week, but it does not define "regular rate." In the Bay Ridge case, the AFL union's contract called for overtime pay for work before 8 a.m. and after 5 p.m. and on Saturday afternoons and Sundays. Some of the employes sued for overtime, under the Wage-Hour law, on top of the overtime they got under the contract. By reasoning that extra pay for working at inconvenient or undesirable hours is simply part of "regular rate" of pay, the Court decided in favor of overtime-on-overtime.

The Administration plans to define as legal overtime any time-and-a-half paid for: 1, work before or after specified hours set by a union contract; 2, holiday, Saturday and Sunday work.

Congress To Review Six Measures on Mining

At least six legislative measures of importance to the mining industry will be brought before the new Congress during the next few months. They are:

Another attempt at bringing back the Premium Price Plan for metals and minerals, probably a rewritten Russell bill. Prospects of passage are about as good as they were last year. Timing this year, one of the troubles last year, should be better.

Amendment of the RFC act to include mine loans. This was passed over last year but is slated for a determined effort now.

Revision of the Contract Termination Act, spelling out application to mining and allied industry. This was passed over during the rush of the last session.

Continuation of the wartime assessment work moratorium, probably for another year, both in Alaska and the U. S.

Continuation for another year of the waiver on copper and lead tariffs. The moratorium expires in March, 1949.

Amendment of the mining laws, to include some sort of leasing system now under study by the Bureau of Land Management.

Controls—allocation and limitation—are the big question now. Tin is certain to remain under some sort of control. If the Administration does advocate conservation controls, a number of metals and minerals are liable for governmental reins. They include steel, copper, lead, tin, antimony, cadmium, manganese, chrome and possibly zinc.

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HAVE ALL FOUR VITAL CHARACTERISTICS FOR SAFE, DEPENDABLE MINE HAULAGE SERVICE

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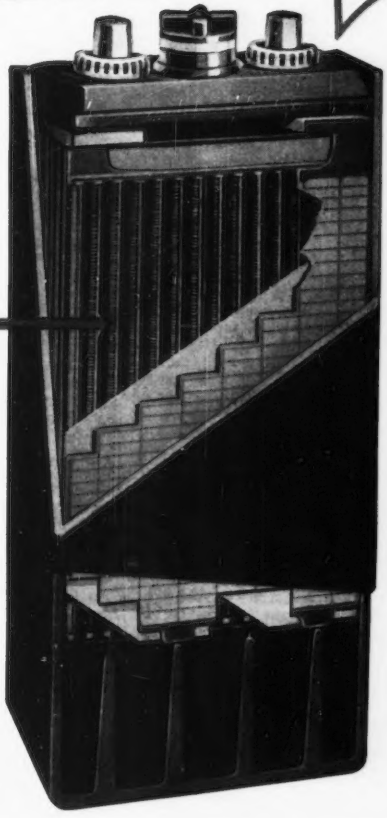
4. **LONG LIFE *and* MINIMUM MAINTENANCE** . . . which add up to better service at a saving.



Because of these outstanding qualities, Exide-Ironclad Batteries are used by more mine operators than all other batteries combined.

Most batteries look much alike on the surface. But inside are the differences that determine power, performance and battery life. One notable difference in Exide-Ironclad construction is the positive plate.

THE POSITIVE PLATE consists of a series of slotted tubes which contain the active material (see small illustration at left). So fine are these slots that, while permitting easy access of electrolyte, they retard active material from readily washing out . . . thus assuring years of safe, dependable, day in and day out mine haulage service.

1888—Dependable Batteries for 61 Years—1949

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NEW BOOKS

HISTORY OF FACTORY AND MINE HYGIENE. By Ludwig Teleky. Columbia University Press, New York. Pp. 342. Price, $4.50.

This history—an outline, the author calls it—is based on a certain part of the literature of the subject. Dr. Teleky says he has depended on his own library, "rich in German, Austrian and English material," also on libraries in New York, the British Information Service and the Engineering Societies. In Germany he worked as a factory and mine inspector. His inspection tours in England, France and the United States, however, he feels, did not yield information specific enough for his purpose, and so he says he has not taken these experiences into account.

As it is, Dr. Teleky thinks much more progress in industrial hygiene has been made abroad than in this country. He unquestionably favors regulation by government. In the United States, he says, the element of education is stressed "in conscious contrast to the issuing of rules and regulations which is the very effective European way." Here, in his opinion, factory inspectors are less highly qualified and less carefully selected than in England and Germany. "American factory inspectors therefore cannot be expected to carry on research and scientific work as do the inspectors in these European countries."

Chapter 10 deals with dust diseases, starting with the observations of Agricola (1556). No reference to aluminum therapy in respect to silicosis is noted, despite the attention it has received in Canadian and American mining practice for more than 15 years. Chapter 11, on "Mines and Miners," deals largely with foreign mines, mainly coal. The author is very complimentary to the U. S. Bureau of Mines—"as a research institution . . . a large and expert staff." "But," he adds, "it does not have the authority to issue any orders or rules."

Dr. Teleky observes further that the danger of dust in ore mines was also increased by the introduction of new, power-driven tools. This is quite true historically, but the statement is on a par with others that are anything but up-to-date. On page 261, concerning fatal accidents, he cites, as interesting, a table by A. H. Fay in a Bureau of Mines bulletin of 1916! However, he subsequently says that in 1946 a mine safety code for bituminous mines was drawn up by Bureau experts. He hopes that the "influence and power of the Bureau will increase . . . and that it will be able to enforce safety in mines."

All in all, the bibliographical data assembled by Dr. Teleky should be useful to anyone who wishes to investigate the subject.

ENGINEERING MATERIALS, SECOND EDITION. By Alfred H. White. McGraw-Hill Publishing Co., 330 West 42nd St., New York 18, N. Y. Pp. 686. Price, $6.

Since the first edition appeared in 1939, many additions have been made to the list of engineering materials. The new book represents a complete revision. As with the earlier one, only enough theoretical explanation is given to enable engineering students to understand why a given material behaves as it does and to learn to use it properly. The materials comprise iron and steel and their alloys, and the non-ferrous metals, including the soft ones and their alloys. Shaping and fabricating are discussed, also steel castings. A chapter on corrosion and protective coatings completes the portion of the book dealing with metals—16 out of 26 chapters.

The 10 chapters remaining consider a wide range of non-metallic products, including various cements; also fuels, wood and wood products, plastic and synthetic coatings. Water and its industrial utilization together with soaps and other detergents are discussed in a chapter by themselves.

THE NEW CONGO. By Tom Marvel. Duell, Sloan and Pearce, 270 Madison Ave., New York. Pp. 395. Price, $5.

Dominating this description of the Belgian Congo is the story of the discovery and exploration of the Congo river and its tributaries. The magnitude of the river system and of the tropical basin it drains will amaze most readers. Few of those whose pursuits have never taken them to Central Africa have more than vague ideas as to the great empire possessed there by Belgium. Their notions of the heart of "darkest" Africa are due to be revised. The existence there of railroads and industries, modern communities, schools and hospitals is a present-day fact. Yet the vast region, rivaling in size the United States east of the Mississippi, is still largely undeveloped.

Congo mining receives attention. The Katanga operations of Union Miniere, the best known today, are sketched at some length. Manono, main theatre for the concern known as Geomines and its mechanized tin mining, is allotted several pages. Manono is an attractive town with paved streets. The adjacent native village shelters 20,000 people, in brick houses surrounded with fruit trees. A third activity described is the mining of industrial diamonds by the Beceka company, controlled by Forminiere.

Looking ahead, the author stresses the increasing medical needs of the Congo. He discusses the impact of teaching by missionaries on native philosophy. He asserts there is a color bar socially, even though it may not exist in respect to occupation. The future of the Congo, he says in conclusion, lies with the *evolué*—the advanced, "evolving" native. The latter has been led far, but cannot be left where he is.

IRON RESOURCES OF CALIFORNIA. Prepared under direction of Olaf P. Jenkins. California Division of Mines, Ferry Building, San Francisco. Pp. 304, plus 25 inserted maps and sections.

Thirteen separate papers describing iron-ore occurrences in as many different areas in California are included in this volume. Eight of the areas are in San Bernadino County, one each in Riverside, Madera and Sierra counties, and one in Shasta County. Additional papers contain respectively a summary of the iron-ore situation in the state, by E. F. Burchard, and a summary of the investigations of the deposits, by A. C. Johnson and Spangler Ricker. A final paper is devoted to the titaniferous iron-ore deposits of the Western San Gabriel Mountains in Los Angeles County. A bibliography and an index are also included. The investigations mentioned are those made by the U. S. Geological Survey and the U. S. Bureau of Mines during the war, now released for publication. Future production is expected to center about the 13 localities dealt with. Over 100 iron deposits are known in California, these being in 31 of the state's 58 counties. Reserves in the state are estimated at between 100,000,000 tons and 150,000,000 tons, more than half of which is said to be submarginal under present economic and technologic conditions. At least a third of the total is in the Eagle Mountains in Riverside County. Large scale exploitation of the deposits began in 1942 when the Kaiser Company's Fontana plant was being built. Subsequent developments have centered about the Fontana operation. During 1942-44 this plant got its ore principally from the Vulcan mine in San Bernardino County. Rising sulphur, however, caused a change to a blende consisting of half Vulcan ore and half an ore from Iron County, Utah. The Vulcan operation ceased in July, 1947, after 2,643,000 tons of ore had been produced. Kaiser's Eagle Mountain mine is expected to supply the future needs of the Fontana plant.

Ryerson Answers Important Steel Questions

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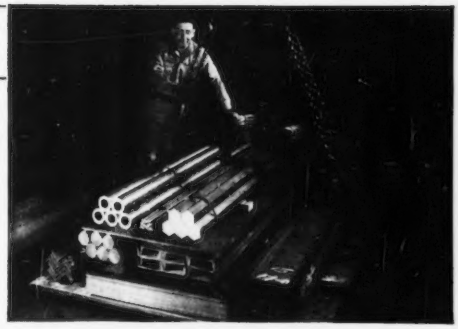
You can usually get enough carbon, alloy or stainless steel from stock to meet maintenance and repair requirements—and some new equipment needs as well. Tremendous demand often limits the amount that can be shipped, but stainless is in particularly good supply—in fact both alloy and stainless bar stocks and carbon and stainless tubing stocks are better than average. See the product list below.



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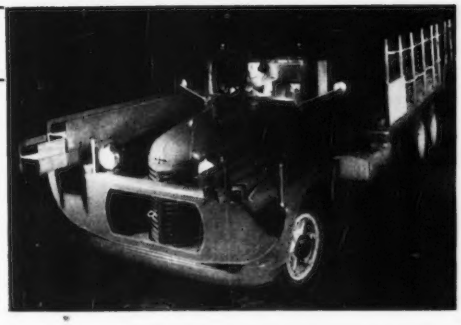
When the steel you need is on hand, you get delivery promptly from Ryerson—24-hour service in emergencies. If your requirements are not immediately available, we may be able to suggest workable alternates. We will certainly do our best. And remember, our stocks turn over quickly. We may have kinds and sizes tomorrow that are out of stock today.



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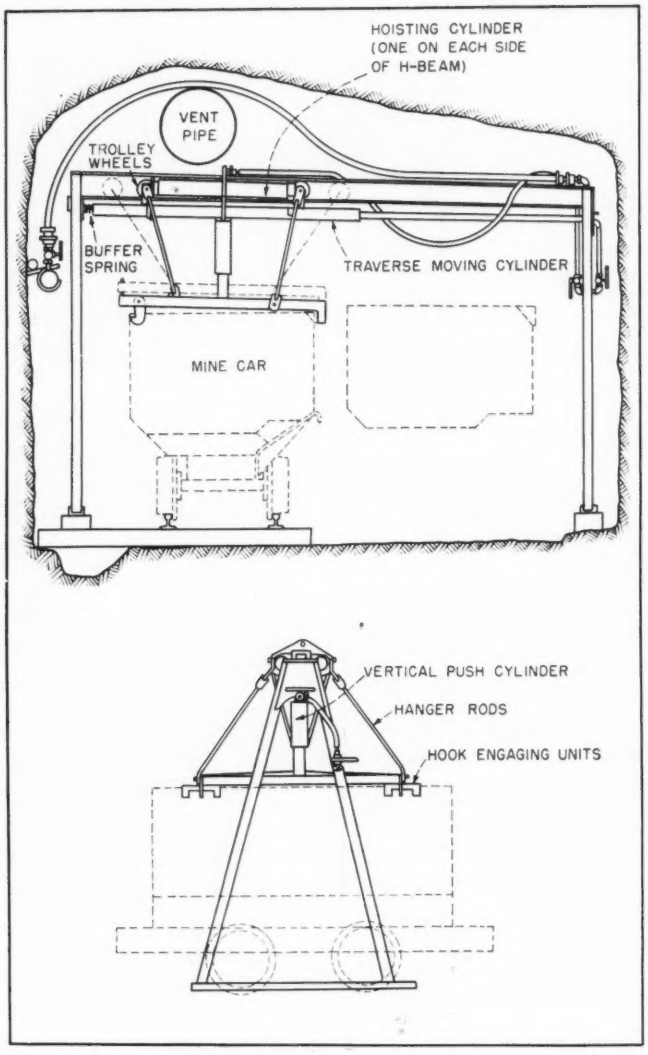
OPERATING IDEAS



Cherry Picker Hoists Cars— Then Transfers Them

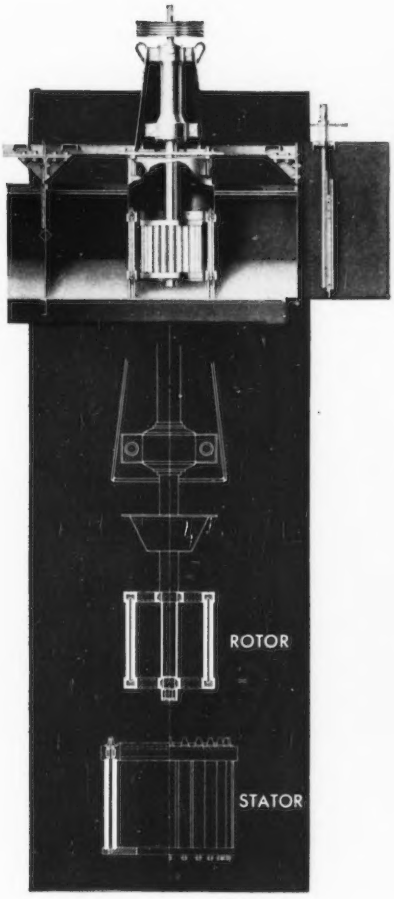
The cherry picker illustrated has given good service in the driving of long development and haulage headings in several large mines active in the Coeur d'Alene mining district. It was designed by Ralph Neyman, superintendent, Hecla Mining Co., Burke, Idaho, and since the granting of manufacturing rights to Coeur d'Alene Hardware & Foundry Co., Wallace, Idaho, the unit has been known locally as the Neyman "side stepper." A patent has been applied for.

The side stepper consists of a monorail beam supported at each end on a simple "A" frame, with quick-change connections; trolley; and four single-acting pneumatic cylinders. Two of the cylinders are used for hoisting, one for transverse movement, and one for downward pushing which also serves as a stabilization guide. Cars are hoisted by a three-point engaging frame attached by suitable lifting rods to the hoisting trolley and vertical pusher piston. All cylinder movements are controlled by two threeway air valves, so situated that the operator stands in a safe position at all times.

As the unloaded trolley approaches the spotted car, the hinged forward hook slides over the side of the body and swings down into normal position by gravity. The trolley continues to move forward and hooks engage the car body the moment the trolley strikes the buffer spring. Next, the car is lifted from the track by actuating the hoisting cylinders, and as soon as air is released from the transverse cylinder, the trolley with lifted car rolls by gravity to the all-clear position. The operations described require about 8 sec. Replacing the car on the track and retracting the trolley—the reverse operation—also requires about 8 sec.

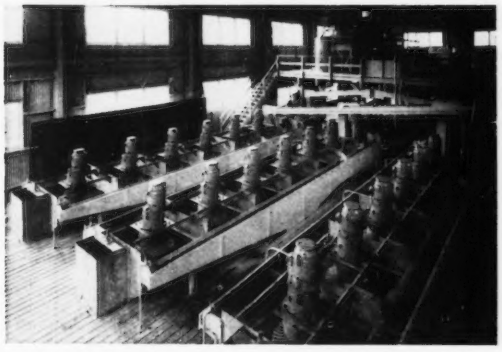
When the unit is to be moved to the next side-stepping station, a car is spotted in the usual position, but the frame is hoisted prematurely so that hooks will not engage. Two or three planks are then placed on top of the car and hoist cylinders released. Simultaneously, the vertical cylinder pushes the frame down on the planks, thereby lifting trolley, beam and end supports. After unwedging "A" frames from walls and pushing them back out of engagement, disconnecting air hoses and lifting hooks, the beam is swung around 90 deg. on the vertical cylinder as a pivot, the long end propped up on the following car. Following loading of the "A" frames, hoses, and other auxiliary units, the dismantled side-stepper is hauled to the next station for reassembly. About an hour is required to complete both operations. The side-stepper described has the capacity to side-step a 1½-ton trammer so that the main haulage locomotive may be coupled directly to an outgoing train of loaded cars.

NOW! The FAGERGREN *Flotation Machine*
is another WEMCO product



Intense aeration and agitation of pulp are accomplished by the unique Rotor-Stator design. Higher speed of float and greater metallurgical capacity result.

- Acquisition of exclusive manufacturing and sales rights to the famous Fagergren Flotation Machine marks another forward step in WEMCO progress.
- To the mineral engineering industry, this combination of superior design and proven engineering experience assures the aggressive development and improvement of flotation methods.
- The adaptability and high efficiency of the Fagergren Flotation Machine combined with the practical engineering competence of the WEMCO organization are guarantees of superior results in the treatment of both metallic and non-metallic minerals. The WEMCO staff includes flotation experts of outstanding reputation in the industry.
- Prompt service to present and prospective operators of Fagergren Flotation machines is available from WEMCO field engineers throughout the United States and in many foreign countries.
- Complete warehouse inventories of replacement parts at major WEMCO offices already have been established. Inquiries and requests for servicing should be directed to one of the WEMCO offices or agents listed below.



The unit, level design of the Fagergren installation in the mill of Bagdad Copper Corporation provides flexibility in flow scheme and simplicity of installation.

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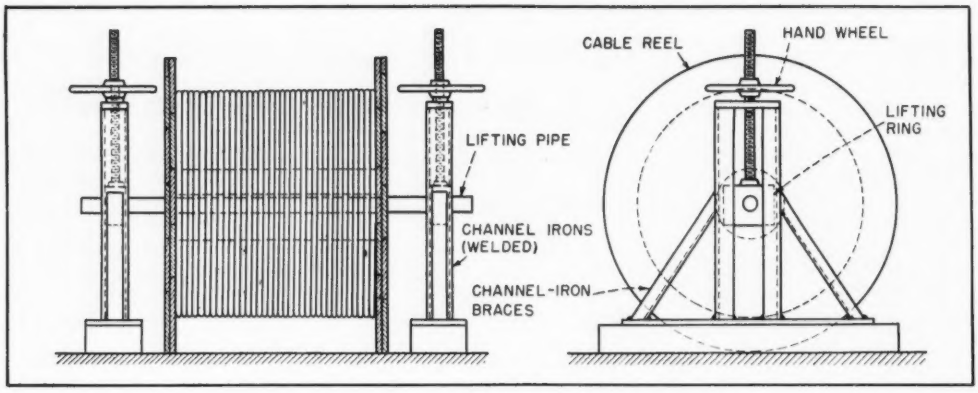
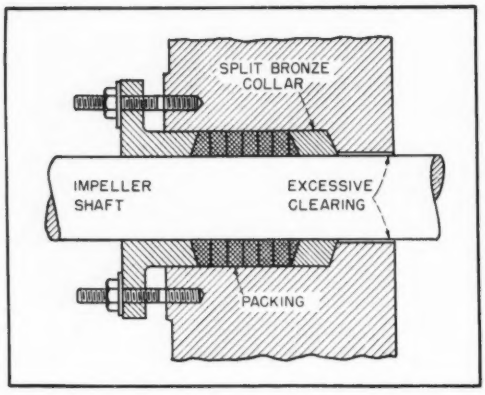


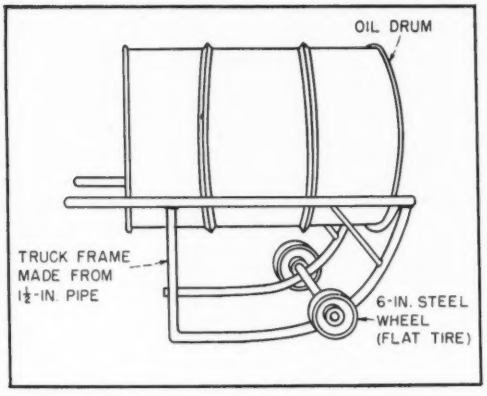
Cable Reel Lifting Jacks

The lifting jacks illustrated and made from scrap material available at any mine machine shop will be found useful for handling heavy cable reels, especially when changing hoisting cables. They are of simple design and made from channel irons and plate steel. Each unit consists of two channels welded to a base plate with side braces made from channel iron welded to the upright channels and base plate; hand wheel with threaded shaft; and a short section of flat iron welded to the top of the channels to form a base for the hand wheel. The upright channels are spaced far enough apart to permit free movement of the lifting pipe between them, and to guide the lifting ring proper. Raising of the cable reel to desired height is done by simply turning the hand wheel on each jack.



Simple Pump Repair

Excessive clearance between the impeller shaft and the stuffing box shaft bore, resulting in frequent shutdowns and lower pump efficiency, posed a problem to the master mechanic at a gold-silver mine in Central Mexico. In addition to shaft vibration, it was difficult to keep the stuffing box dry and packing failed frequently. The difficulty was satisfactorily overcome by installing a bronze collar in the stuffing box of the centrifugal pump as shown in the accompanying illustration. The collar is of split design to permit insertion into the stuffing box opening without disconnecting the pump from the motor and removing coupling on the pump shaft. Since installing the collar no trouble has been experienced with the packing.



Oil Drum Rack and Truck

Faced with the necessity of providing some means of handling large drums of lubricating and quenching oil at the machine shop of a large gold-silver mine in central Mexico, the master mechanic designed and built the combination rack and truck unit illustrated from scrap material. The frame, handles and cradle for the drum are made from 1½-in. pipe, welded, and the wheels made up from steel discs and welded-on flat tires operate on a short steel axle welded to the truck frame, which supports the load on pipe-nipple bearings in the wheels.

The use of this truck is not limited to the machine shop. It can be used equally well in the mill for transporting liquid reagents and other supplies.

For conveying rock to the site of Bull Shoals Dam—a flood control and hydroelectric project.

Those idlers or "rollers" you see above are a vital part of the longest conveyor system in existence.

13,888 of them stretch all the way from Lee's Mountain down to Bull Shoals dam site on the White River in Arkansas, seven miles away.

Now in operation, with the conveyor belt in place, each idler shown above must support the movement of nearly ten tons of crushed rock every minute! Before the Bull Shoals Dam is completed, 4,000,000 tons of limestone will have moved over these Robins Idlers!

The engineers in charge knew that these idlers—made by Hewitt-Robins—could handle this great tonnage . . . and then some. That's because the rigid truss design of Robins Idlers is *stronger than any other type of construction!*

Moreover, they knew that seven miles of idlers, rolling day and night, must be sound in design. And Robins Idlers—with patented One-Shot Lubrication and Triple Grease Seal—*roll longer—take less care, less grease.*

This seven-mile roller coaster is only one of thousands of belt conveyors equipped with Robins Idlers.

Hewitt-Robins is the only company that is prepared to engineer, build, and install both machinery and belting *as a single unit.*

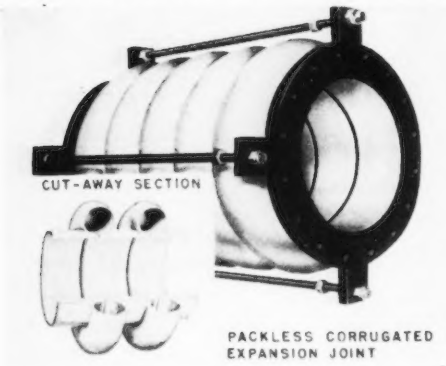
ROBINS

CONVEYORS

So whether you're interested in machinery, belting, or an entire belt conveying system, consult Hewitt-Robins. Write to Hewitt Rubber Division, Buffalo 5, N. Y.; Robins Engineers Division, 157 Chambers St., New York 7, N. Y.; Robins Conveyors Division, Passaic, N. J.

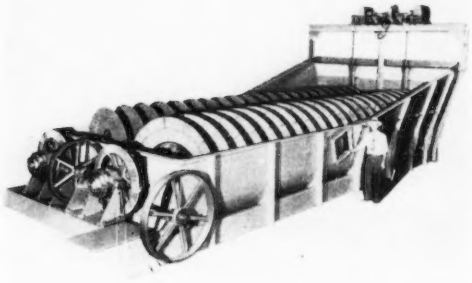
ROBINS CONVEYORS DIVISION **HEWITT-ROBINS INCORPORATED**

EQUIPMENT NEWS



NEW PACKLESS CORRUGATED EXPANSION JOINT, available for pipe sizes from ½ in. to 25 ft., will withstand pressures from vacuum to 50,000 psi., and temperatures up to 2,000 deg. F. Maker is Marquette Coppersmithing Co., Philadelphia 47, Pa.

GIANT RUBBER-TIRED TWO-ENGINE Moto-Crane announced by the Thew Shovel Co., Lorain, O., has a safe lifting capacity of 45 tons at a 12-ft. radius. Length of the crane with the boom in travel position over the front of the carrier is 11 ft. 7¾ in.

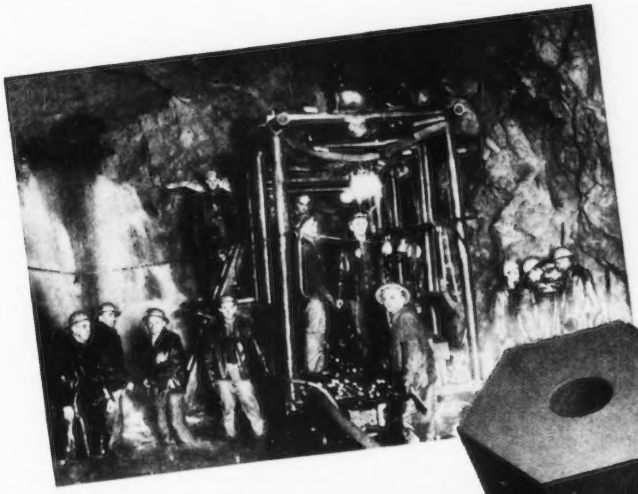


THIS 66-IN. DUPLEX DOUBLE PITCH Akins classifier, largest of this type ever built, will be used in the reclamation section of the Pauway No. 4 phosphate plant at Lakeland, Fla. The unit was built by Colorado Iron Works, Denver, Colo.

NEW SIDE-DUMP OFF-THE-HIGHWAY earth moving equipment has a capacity of 40,000 lb., and struck measure capacity of 13 cu. yd. Diesel engine is 200 hp. Top speed loaded is 33.4 mph. The unit is announced by the Euclid Road Machinery Co., Cleveland, Ohio.

BOTTOM-DUMP TRAILER built by the Easton Car & Construction Co., Easton, Pa., is designed to haul 32 tons of coal. Model TB-4030 features a radial gate, air-powered and operated from either the cab of the tractor or the rear of the trailer.

SUSPENSION BRIDGE supports 30-in. steel cable rubber belt designed and built by Goodyear Tire & Rubber Co., Akron, Ohio, for coal plant of U. S. Steel Corp. at Gary, W. Va. The belt handles 350 tons of shale and rock per hour. Bridge is inclined at 19-deg. angle.



CHARACTER is what counts in drill steel

CRUCIBLE

Hollow drill steel has CHARACTER

It's better to buy drill steel with character and reliability as you need speed and consistently low drilling costs. Crucible character in drill steel is something that is established by the experience of thousands of users. Its constant quality performance for these customers is the cumulative proof that this drill steel is giving them profitable results. That's the kind of reputation Crucible's Hollow Drill Steel has earned in construction, mining and quarrying during the past half century.

More rock drilled for less money

Prior to shipment, every lot of Crucible's Hollow Drill Steel is checked and tested for the following: Uniformity of analysis and structure; excellence of shank qualities; resistance to fatigue; concentricity of hole; stiffness; and accuracy of section. The result is drill steel that takes maximum punishment from modern drill equipment; drills more rock for less money . . . consistently.

You can get Crucible's Hollow Drill Steel in both carbon and alloy types . . . Crusca and "Park A" Alloy . . . in 3 shapes and all sizes. Your Crucible salesman can also supply you with alloy and Max-el machinery steels, high speed tool bits, alloy and carbon tool steels, and Rexweld hard surfacing welding rods. Crucible makes a full range of quality steels for industry.

3 shapes all sizes

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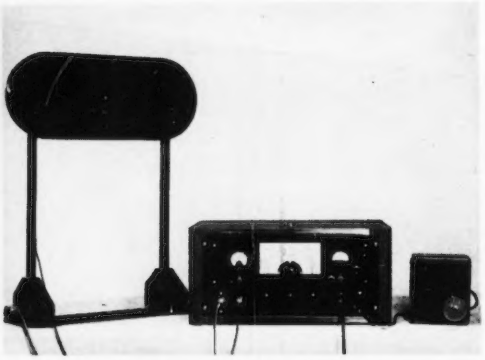
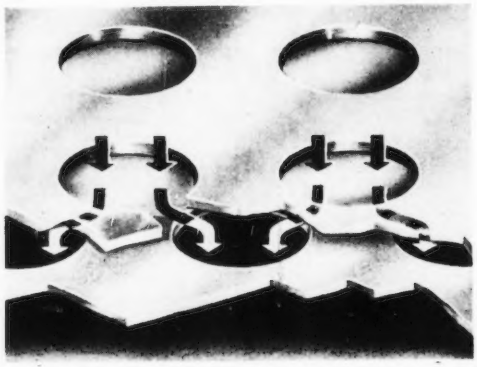
SIX-CYLINDER DIESEL TRACTOR, the TD-18, largest in the International crawler line, is shown here operating a 14-ft. Isaacson bulldozer on large-scale stripping operation. Planet power steering system features fingertip control for operator.

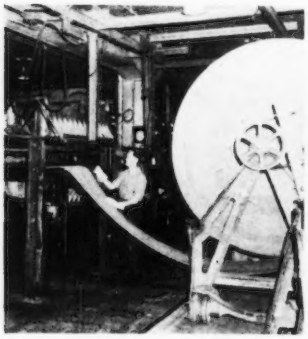


NEW BELT LOCATOR made by Fischer Research Laboratory, 1961 University Ave., Palo Alto, Calif., detects small metallic objects on conveyor belt, whether magnetic or non-magnetic. Relay at right will stop belt and flash warning light.

THIS WALKING DRAGLINE, with bucket capacity of 5 to 7 cu. yd. is now being produced at the newly acquired branch plant of the Marion Power Shovel Co., at Cambridge, Ohio. It is expected that two machines, Type 7200 shown above, will be built per month.

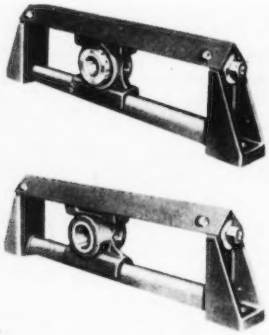


NON-PLUGGING LONG-LIFE FILTER MEDIUM consists of two thin sheets of non-corroding metal with .045-in. dia. holes (about 120 per sq. in.) Neva-Clog screen can be adapted to drum and disc filters. It is made by W. S. Rockwell Co., Fairfield, Conn.

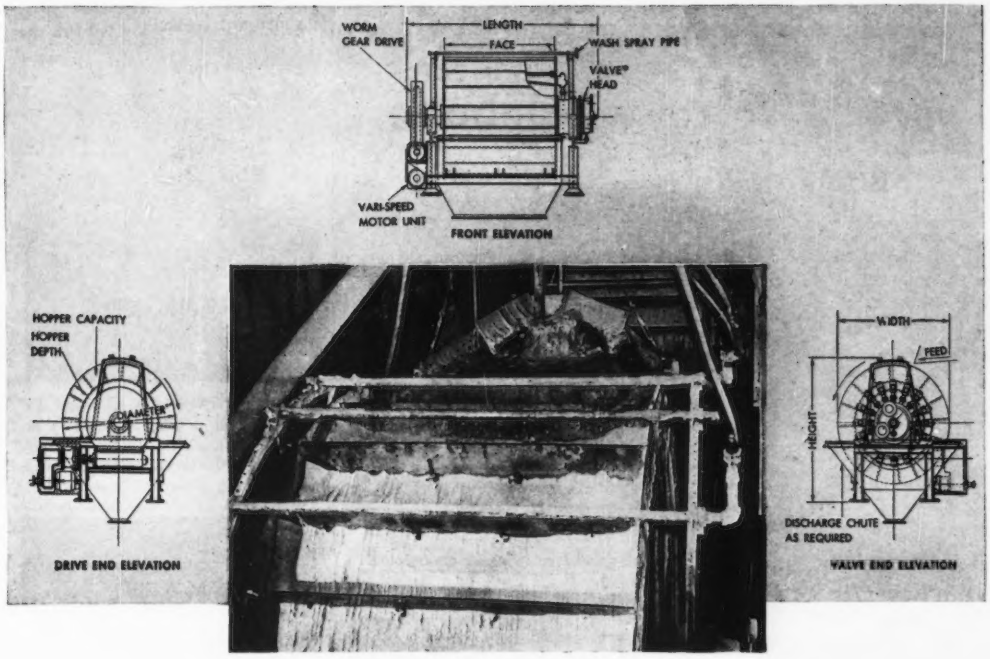


RAYON AND NYLON enable this new "Raynile" conveyor belt to withstand tensions as high as 1,000 lb per in. of width. It is made by Hewitt Rubber Division of Hewitt Robins, Inc., Buffalo 5, N. Y.

SACKS, BOXES AND BARRELS can be loaded through box car doors and handled in mills and surface plants with this flexible conveyor announced recently by H. W. Creager Mfg. Co., Arvada, Colo.



NEW TAKE-UPS, Type E, above, equipped with Timken bearings, and babbitt Type H, below are announced by Dodge Mfg. Corp., Mishawaka, Ind. A wide range of sizes are carried in stock.



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The Conkey Rotary Hopper Vacuum Dewaterer is a high capacity top feed vacuum filter for fast filtering and rapidly segregating slurries. The design takes advantage of the quick filtering characteristics of slurries as well as the tendency toward segregation of coarser and heavier solids. By taking full advantage of the effect of classification with relatively high drum speeds, cloth blinding is maintained at a minimum and large capacities assured. With Conkey design, no adjustments of feed consistency are necessary and continuous automatic operation requiring practically no supervision is achieved.

Conkey Rotary Hopper Vacuum Dewaterers are used with great success in the dewatering of classified oversize, in the filtration of magnetic, table and flotation concentrates. Some of the materials dewatered successfully include:

Concentrates	Ilmenite	Abrasives
Slag	Phosphate Rock	Feldspar
Magnetite	Silica Sand	

A General American engineer experienced in solving dewatering problems will be glad to discuss your problem with you. Write today for Bulletin No. 101 which describes the Conkey Rotary Hopper Vacuum Dewaterer.

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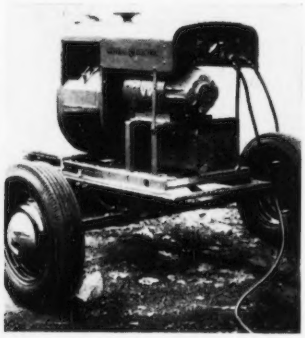
Equipment News *(Continued)*

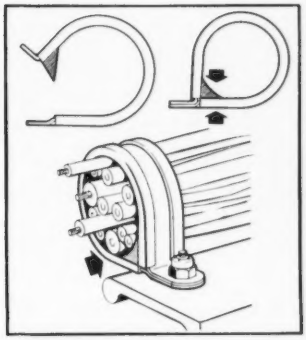


NEW LIGHTWEIGHT engine-driven d.c. welder mounted on pneumatic trailer is announced by General Electric Co., Schenectady 5, N. Y. Unit weighs 660 lb. Maximum welding current is 250 amp.

SMALL-SIZED Tournapull Model D. Roadster travels at speeds up to 25 mph. and handles 8 tons in a Carryall scraper, Model E-9. The equipment is announced by R. G. LeTourneau, Peoria, Ill.

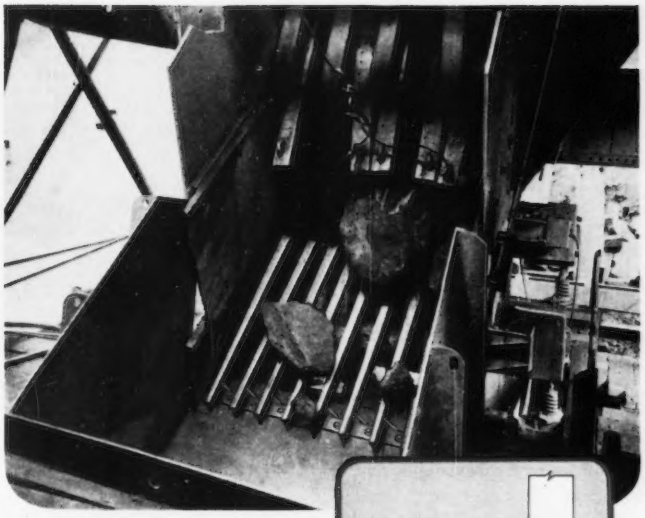
STREAMLINED RESPIRATOR announced by the American Optical Co., Southbridge, Mass. is lightweight, inexpensive, and contains an easily replaceable filter in a light retainer cup.

NEW GEAR GREASE announced by Keystone Lubricating Co., Philadelphia 32, Pa., is effective in temperatures ranging from sub-freezing cold to above 400 deg. F. Product is called Grease No. 32.

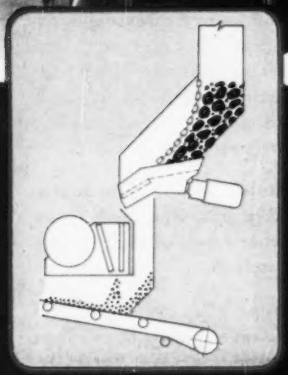


V-SHAPED RUBBER WEDGE vulcanized to rubber-covered clamp assures safety against short circuits. This wire harness clamp is made by Thomas Associates, 4607 Alger St., Los Angeles 26, Calif.

LABORATORY SHAKER shown above is shaking a 5-gal. bottle. The variable speed model is made by Erbach and Sons Co., Ann Arbor, Mich. Write to the company for illustrated bulletin describing shaker.



JEFFREY-TRAYLOR
Electric Vibrating
GRIZZLY FEEDER
BY-PASSES FINES AHEAD OF CRUSHERS—PROTECTS BELT WITH CUSHION OF FINES . . . SAVES WEAR ON CRUSHER PARTS



Electric Vibrating Feeders are often equipped with a grizzly section at the discharge end for combining feed control with a rough, coarse sizing operation. They are used extensively to by-pass fines ahead of primary and secondary crushers and picking belts to scalp out large pieces ahead of screens—and to protect belt conveyors by bedding with fines thus providing a cushion for large jagged lumps. This type of unit provides a feeder and non-clogging grizzly in a single unit. It saves installation and operating expense as well as conserving headroom. Consult Jeffrey Engineers on equipment best suited to your Metal Mine needs.

Installation shown is a Jeffrey-Traylor electric vibrating grizzly feeder ahead of primary crusher equipped with tapered steel bars. Tonnage 600 T.P.H.—4' x 0 cubes.

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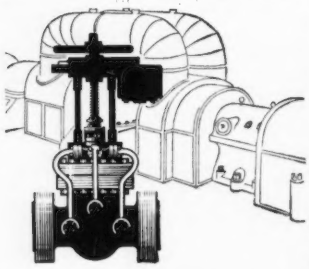

high pressure and high temperature

Not so many years ago, designers shunned gray iron for high pressure and high temperature usage. This is all changed — such castings are now freely specified.

Molybdenum has made possible this type, and many other types, of high quality cast iron.

Some high pressure steam valves are made of cast iron containing 3.10% Total Carbon, 2.45% Silicon, 0.75% Manganese with 0.75% Molybdenum added. This composition, and hundreds of other examples of the economical application of Molybdenum cast iron, are to be found in our new booklet, "Applications of Molybdenum Cast Irons". Write for it!

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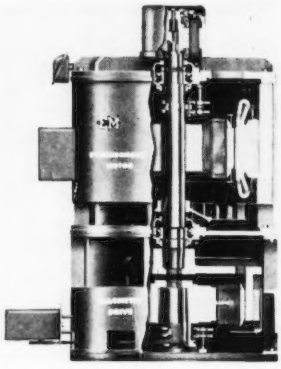
Equipment News *(Continued)*

WINCH DUMP TRAILER, available in 8 to 12-cu. yd. sizes for sand and aggregate, made by Winch-Lift, Inc., Shreveport, La., raises trailer bed into dumping position by means of a winch, cable, and sheave blocks operated by power take-off. Strong tubular arms are forced into jacknife position as rear axle of the truck and trailer axle are drawn together by cables. Weight of 8-cu-yd. unit is 5,600 lb.



ADJUSTABLE speed control for centrifugal pumps is provided by synchronous motor magnetic drive unit made by Electric Machinery Mfg. Co., Minneapolis 13, Minn.

TWIN-DISC HYDRAULIC DRIVES are installed on these Dart trucks hauling 20-ton loads on the Iron Range. Dart Truck Co., Kansas City Mo., uses drives made by Twin Disc Clutch Co., Kansas City, Mo.

NEW CLAMP for flexible conduits requires no tools to set up or release it. It consists of an overlapping non-rusting band and strap. The clamp is made by Flexible Tubing Corp., Branford, Conn.

NEW RIVETER AND KIT for relining shovel, crane and dragline bands is announced by the Raybestos Division of Raybestos-Manhattan, Inc., Bridgeport, Conn. The riveter can be disassembled.

BULLETINS

Magnetic Detector. A new high-intensity magnetic detector for tramp iron on belts and in chutes is described in Bulletin B-1901A recently released by Dings Magnetic Separator Co., 4740 W. McGeogh Ave., Milwaukee 14, Wis.

Saving Money by Metallizing. Metallizing Engineering Co., Inc., 38-14 30th St., Long Island City 1, N. Y., explains how to solve pump maintenance problems in "Metco News" Vol. 4, No. 5, which may be obtained by writing to the company.

Thermocouple Manual. Write to Wheelco Instruments Co., Harrison and Peoria Sts., Chicago 7, Ill., for a copy of the 40-page manual on thermocouples.

Silicones. Dow Corning Silicone Notebook, Fluid Series No. 3 may be obtained from the company at Midland, Mich. The booklet describes DC 200 silicone fluids notable particularly for their lubricating quality at high temperatures without breaking down.

Pneumatic Conveying. Bulletin No. 102, published by Convair Corp., 1501 Potomac Ave., Pittsburgh 16, Pa., contains plant flowsheets showing installations of pneumatic equipment to convey sands, powdered solids and granular materials.

Speed Measuring Instruments. Tachometers, frequency meters, rate-of-vibration meters, precision stop watches, and similar instruments are described in Bulletin 35 issued by James G. Biddle Co., 1316 Arch St., Philadelphia 7, Pa.

Corrosion-Resistant Concrete. "Lumnite Concrete Floor" is the title to a booklet recently announced by the Lumnite Division of Universal Atlas Cement Co., 135 E. 42nd St., New York 17, N. Y. Full details are given about this product which has been used successfully in copper smelters and manufacturing plants. Lumnite concrete is corrosion and heat-resistant.

"You and Your Future." This is the title to a booklet describing and illustrating the Coleman Universal Spectrophotometer which is useful for chemical analysis in mills and smelters. The booklet may be obtained from Coleman Instruments, Inc., 318 Madison St., Maywood 1, Ill.

Vertical Pump Motor. The verticlosed motors, a new development in the deep-well vertical pump motors, is described and illustrated in color in Bulletin No. F-1454 issued by U. S. Electrical Motors, Inc., 200 East Slauson Ave., Los Angeles 54, Calif.

Reduction Crusher. The Allis-Chalmers Type "R" reduction crusher is described and illustrated in Bulletin 07B6006E issued by Allis-Chalmers Manufacturing Co., Milwaukee, Wis. The unit comes equipped with a "speed-set" control and automatic reset.

Load-Center Substation. Bulletin 11B6285A issued by the Allis Chalmers Manufacturing Co., Milwaukee, Wis., tells how standardized load center unit substations are installed and why they save money.

Tungsten Electrodes. Fansteel Metallurgical Corp., North Chicago, Ill., has published Bulletin 1.102 which describes tungsten electrodes for inert gas and atomic hydrogen welding. The rods contain 99.9% pure tungsten. Tungsten melts at 6152 deg. F. The rods are used to weld stainless steel.

Wire Rope Book. Colorado Fuel and Iron Corp., Wickwire Spencer Steel Division, 500 Fifth Ave., New York 18, N. Y., offers a new Wickwire Rope Catalog which is virtually a handbook on wire rope selection, care and installations. The 187-page leatherette-bound volume may be obtained by writing to the New York office of the company.

Safety Air Hoist. Safety piston-type air hoists for smooth lifting of objects around the mine and mill where compressed air is available are described and illustrated in File 258, published by Miller Motor Co., 4027 N. Kedzie Ave., Chicago 18, Ill. The units are available with piston bore of 3½ to 14 in., for pressures of 60, 80, or 100 psi., and with lifting capacities of 451 to 14,903 lb. Stroke is 36 in. or more.

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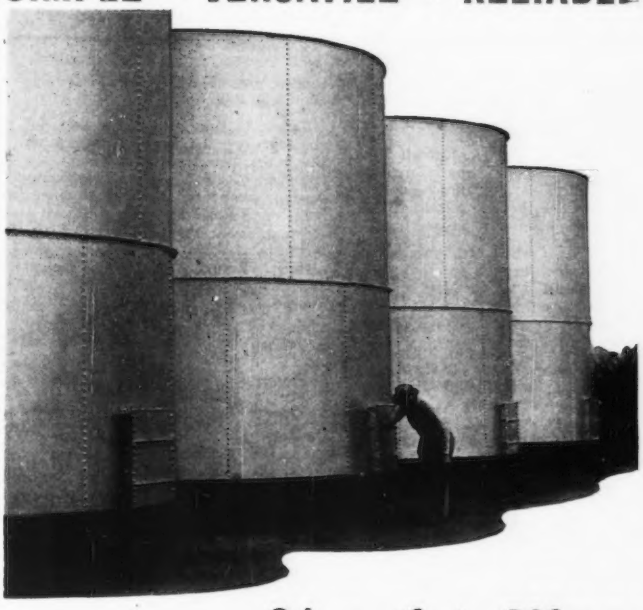

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PERSONAL NEWS

Vernon L. McCutchan, manager of operations for Cerro de Pasco Copper Corp., since 1944, has retired. He joined the company in 1919 as a junior mining engineer. **A. Russell Merz,** assistant manager of operations, succeeds him. Prior to joining Cerro de Pasco in 1945, he was assistant general manager of Tin Processing Co.

Irwin H. Cornell, who retired as vice president and sales manager of St. Joseph Lead Co. on May 10, 1948, has been named lead consultant to the Bureau of Federal Supply, Department of the Treasury.

F. H. Chapman, for 22 years associated with Consolidated Mining & Smelting Co., Trail, B. C., has been appointed secretary of the British Columbia Association of Professional Engineers. **A. D. Greer,** former secretary, has become registrar.

Miss Irene Klein, member of the headquarters staff of the AIME, and **Ernest Harvey Sharp,** of the Eagle-Picher Co., announced their engagement late in November. The wedding will take place Jan. 15 and the couple will make their home in New York.

Harmon H. Gruse, former electrical engineer of the Nantahala Power Co., a subsidiary of the Aluminum Company of America, has been promoted to vice president in charge of engineering. His headquarters will be in Franklin, N. C.

Dr. Clarence Zener, professor of metallurgy at the Institute for the Study of Metals, University of Chicago, is serving as special lecturer and consultant in physical metallurgy in the department of mining and metallurgical engineering of the University of Illinois.

Charles M. Brinckerhoff, Andes Copper Mining Co., was recently appointed general manager of the Chile Exploration Co., Chuquicamata, Chile, to succeed **Mat Sample,** retired after 35 years with the company. **N. F. Koepel** has been appointed general manager of the Andes Copper Mining Co. succeeding Mr. Brinckerhoff. **D. M. Dunbar,** assistant general manager at Chuquicamata, has been promoted to assistant to the executive vice president of both companies in New York.

Louis Ware, president of International Minerals & Chemical Corp., was elected a director of the Illinois Central Railroad Co. at a meeting of the board of directors, Nov. 30.

Jack Hanna, mine operator in the Greenwood district, British Columbia, has been placed in charge of the Greenwood mine and mill of Brooklyn-Stemwinder Gold Mines, Ltd., according to an announcement by **Victor Golden,** president, and **Edward Kellner,** managing director.

James E. Quigley has been elected chairman of the Tintic Small Mine Operators, Leasers & Prospectors Association, Eureka, Utah. The organization, composed of about 90 members, was formed for the purpose of a more coherent representation of the interests of the mine operators in the district. **Robert E. Watt** was named secretary-treasurer; the directors are **Joseph J. Cherry, John G. Hall, William Bridgeman, Brennan Hannifin** and **Ralph Hopes.**

DR. LEWIS E. YOUNG

Dr. Lewis E. Young, consulting mining engineer and former vice president of the Pittsburgh Coal Co., has been elected president of the American Institute of Mining and Metallurgical Engineers for 1949. He will formally assume his duties at the annual meeting of the Institute in February in San Francisco. Dr. Young was elected a director of the AIME in 1937, and served as vice president from 1942 to 1945. He has written numerous technical papers on mine mechanization and mining practice.

Clifford S. Gibson, safety director of the Ontario Mines Accident Association, Timmins, Ontario, has recently returned from a tour of the western United States, where he made a study of ventilation, dust control, refrigeration, fire prevention and safety methods. The study was also made in behalf of the Ontario Mining Association.

Benson D. Blackie and **Hartzel C. Slider,** students of petroleum and mining engineering at Ohio State University, were recently chosen as president and vice president of the newly formed Prospectors' Club. The purpose of the club is to promote a joint understanding of diversified interests of the petroleum and mining industries.

William D. Lord, Jr., has been named mine superintendent of the International Mining Co.'s Minas Chojlla, Bolivia. The International Mining Co. is an enterprise of W. R. Grace & Co., New York.

Andrew Roark, Mulenberg County, Kentucky, has been elected president of the Western Kentucky Mining Institute. He succeeds **H. B. Hinton.**

Arthur S. Hecht, consulting mining engineer for the Department of Commerce, USAFIK, Korea, recently returned to the United States. He is being retained by the Civil Affairs Division of the Army to act as consultant on technical matters concerning ore beneficiation tests now in progress in this country. His present address is 342 27th Ave., San Francisco 21, Calif.

David White, formerly geologist with Alcoa Mining Co., has joined the staff of the Oregon State Department of Geology and Mineral Industries.

J. C. Landonberger, Jr., Utah Copper Division, Kennecott Copper Corp., has been elected chairman of the Utah section, American Institute of Mining & Metallurgical Engineers. He succeeds **W. C. Page,** U. S. Smelting, Refining & Mining Co. **Byron E. Grant,** general superintendent of the U. S. and Lark mines of U.S.S.R.&M., is vice chairman and **R. C. Cole,** American Smelting & Refining Co., was re-elected secretary.

C. H. Hopper, until recently consulting engineer on diamond drilling with Boyles Brothers Drilling Co., Kirkland Lake, Ont., is in charge of rock excavation for Shawinigan Engineering Co. at its Trenche Development, Rapide Blanc, Quebec. The rock job immediately in hand is for a 400,000-hp. generating station to cost roughly $35,000,000. Excavation of 700,000 cu. yd. of rock is involved.

E. A. Friedman, general superintendent for Oliver Iron Mining Co. in the Coleraine district, announced the appointment of **Robert F. Knight** as master mechanic for the district.

E. M. Richards, vice president in charge of mining operations, Republic Steel Corp.; **E. F. Fitzhugh, Jr.,** geologist; **Oscar Lee,** preparation engineer, and **William Gosewisch** of the purchasing department, recently inspected the company's iron ore mines on the Mesabi range and in Michigan. They were accompanied by **F. H. Cash,** Duluth, general manager of Republic's Lake Superior iron mines.

Franklin Coolbaugh, son of **Dr. M. F. Coolbaugh,** president emeritus of the Colorado School of Mines, has been made assistant general superintendent of the Climax Molybdenum

Co., Climax, Colo. He was formerly mill superintendent.

William Riddle has been made manager of the Billings office of the Land Management Bureau of the Department of the Interior. **Thomas F. Corbally** will continue to manage the Great Falls office.

J. C. Madson, recently retired general superintendent of Jones & Laughlin's Benson mines, Star Lake, N. Y., spent some time at Hibbing recently. He expects to make his permanent home in New York State.

A. F. Peterson, general manager of the mining division, Bethlehem Steel Co., has been elected vice president. He succeeds the late **M. L. Jacobs**. Mr. Peterson was at one time in the Michigan iron ore field with Pickands, Mather Co.

John C. Howbert, Denver mining engineer, and **M. D. Van Delinder**, Butte mining engineer, are now with the Oliver Iron Mining Co.'s engineering department at Coleraine.

Warren L. Howes, San Diego, Calif., is now chief engineer and manager of Western-Knapp Engineering Co.'s Hibbing office, succeeding **J. H. Glennon**. The Western-Knapp company is erecting a heavy-density plant for the Mesaba-Cliffs Co.'s Holman-Cliffs mine at Taconite, Minn., and is also planning such a unit for Inter-State Iron Co.'s Hill-Annex mine at Calumet, Minn.

A. Chester Beatty, English mining administrator, received the Egleston Medal, awarded to him by the Columbia University Engineering Alumni Association last April, at a dinner in his honor on Dec. 1. The award is given annually for distinguished engineering achievement.

A. F. J. Heather has been made mine foreman at the Howe Sound Exploration Co., Snow Lake, Manitoba.

Earl S. Mollard, general superintendent, and Gust Weggum, mechanical superintendent, of Butler Brothers, recently investigated pumping operations in the Florida phosphate field.

Walter F. Schwedes, electrical engineer with the Oliver Iron Mining Co. at the Duluth general offices, retired Oct. 18. He has been with the Oliver company since 1912.

E. A. Lambert, formerly purchasing agent for Butler Brothers in their St. Paul office, is now at Hibbing in the M. A. Hanna Co.'s purchasing department.

John E. Bemis, mining engineer, has joined the engineering staff of M. A. Hanna Co. at Hibbing, Minn.

J. H. Baker, Canadian Exploration (Tanganyika), Ltd., was recently elected chairman of the Tanganyika Mining Association. **H. H. Merritt**, Geita Gold Mining Co.; **J. De la Vallee Poussin**, Uruwira Minerals, Ltd.; **A. A. Friedman**, New Saza Mines, Ltd., and **A. Doyle**, of Dar es Salaam were elected committee members.

Thorold Field, Duluth, and **Orvil R. Whitaker**, Denver, consulting mining engineers, have been appointed to the Atomic Energy Commission's Advisory Committee on Raw Materials (formerly the Advisory Committee for Exploration and Mining). Other members of the Committee are: **Donald H. McLaughlin**, president, Homestake Mining Co.; **Everette L. DeGolyer**, petroleum geologist, Dallas, Tex.; **Wilbur Judson**, vice president and director, Texas Gulf Sulphur Co.; **Robert E. McConnell**, McConnell Foundation, New York; **Fred Searls, Jr.**, president, Newmont Mining Corp., and **Clyde Williams**, director, Battelle Memorial Institute.

STOREY BUCK

Storey Buck, former mining editor of the *Chronicle*, Spokane, and for many years news correspondent for *Engineering & Mining Journal* at Spokane, Wash., has retired. Mr. Buck joined the *Chronicle* staff nearly 50 years ago. His knowledge of mining in the Pacific Northwest and his love for visiting mining districts made it fitting that he become mining editor, which position he held until four years ago.

Augustus B. Kinzel, president, Union Carbide & Carbon Research Laboratories, and **Philip Kraft**, vice president, Newmont Mining Corp., were recently elected vice presidents of the American Institute of Mining and Metallurgical Engineers. Four new directors elected were: **William J. Coulter**, general manager, Climax Molybdenum Co., Denver; **James L. Head**, mining engineer, Anaconda Copper Mining Co., New York; **W. M. Peirce**, chief, research division, New Jersey Zinc Co., Palmerton, Pa., and **George P. Swift**, consulting engineer, Waltham, Mass. Six new directors ex officiis as chairmen of professional divisions of the Institute elected are: **Frederick N. Rhines**, chairman, Metals Division; **Lloyd E. Elkins**, Petroleum Division; **C. D. King**, Iron and Steel Division; **E. R. Price**, Coal Division; **Howard A. Meyerhoff**, Industrial Minerals Division; **S. J. Swainson**, Mineral Beneficiation Division.

John C. Russell, formerly of the Mineral Dressing Division, American Cyanamid Co., has resigned to join the staff of the Consulting Engineering Division of the Dorr Co.

Paul Robinson, metallurgist, Idaho Springs, Colo., recently spent several weeks at Grant's Pass, Ore., where he was engaged in examination of a proposed mining and milling operation.

LETTERS

To the Editor

In a recent issue of the E&MJ, your Washington correspondent characterized the proposed Russell bill (HR-6623) as a "pork barrel bill." Elsewhere the bill was similarly referred to as a "gravy train." These characterizations seemed to be based on those provisions of the bill which would have allowed subsidies to the extent of some 13c. a pound over the present market price of copper and in the order of 5c. to 8c. over present lead and zinc prices. It was evidently assumed that all marginal operators would receive these maximum subsidies, thereby earning enormously exorbitant profits.

The bill was plain that these allowable subsidies were only maxima, and it provided administrative powers to vary payments according to the facts of each operation. I think it relevant to examine the results of application of a similar system, that is, the Premium Price Plan.

Maximum subsidies available were stable during the years 1942-1944, as were metal prices. During these years the following results (cents per pound):

	Minimum Subsidy Specified to Be Paid on All Premium Metal	Maximum Subsidy Allowable to Any Individual Producer	Average Subsidy Actually Paid on All Premium Metal
Copper	5.00c	15.00c	5.80c
Lead	2.75c	5.50c	3.50c
Zinc	2.75c	8.25c	4.40c

That is, the administrators were constrained by regulation to pay not less than 5.0c. per pound for all premium copper (which was of course only a part of total copper production), but they had the option to pay as much as an additional 10.00c. premium in any individual instance. They actually paid an average on all premium copper of 5.8c. Thus the 8/10c. above the specified minimum represents the extent to which the administrators exercised their option on the available discretionary 10c. Similar figures for the other metals are apparent in the table above.

Turning to the question of exorbitant profits, all available data on this subject for the year 1942-1944 were tabulated, summarized and published. They covered a large portion of all premium metal. They are sum-

marized in the following table:

Mines Producing Premium Metal	Tons Metal	Operating Margin Cents per Pound Metal
Lead-Zinc Mines		
Ex Tri State	945,000	1.5c
Tri State Mines	446,000	1.9c
Copper Mines	996,000	2.3c

I think such margins as these could be considered light, but not piquant sauces, and I doubt whether any mining man could stretch his imagination sufficiently to call them even thin gravy. Any pork involved was, I believe, of the razor-back variety.

It would seem, then, that unless we assume incompetence, venality, or positive misprision on the part of the administrators, provision of maxima such as those of the Russell bill need not cause a subsidy system to become a "gravy train" or a "pork barrel".

JESSE L. MAURY

Chevy Chase, Maryland

OBITUARIES

William Harvey Emmons, 71, professor emeritus of geology and mineralogy at the University of Minnesota, died Nov. 5 at his home in Minneapolis. He served as head of the department as well as director of the Minnesota Geological Survey from 1911 until his retirement in 1944.

J. Leonard Replogle, chairman of the board of Warren Foundry and Pipe Corp., which owns the Mt. Hope iron mine near Dover, N. J., died Nov. 25, aged 72. Mr. Replogle headed the Steel Division of the War Industries Board in the first World War. He was a former president of the Vanadium Corporation of America.

Robert L. Brainard, 65, Wardner, Idaho, mining editor and mining executive, died Nov. 17 in Kellogg, Idaho. Editor of the Kellogg *Evening News* and the Kellogg-Wardner *News*, he was also president of Nancy Lee Mines, Metropolitan Mines Corp. and Hypotheek Mines.

W. R. Marston, chief electrical and mechanical engineer, American Smelting & Refining Co., Mexico, died Oct. 6 in Monterrey, Mex. He was 60.

Dr. Lionel H. Duschak, 66, professor of metallurgy at the University of California, died Nov. 27. He was research engineer for the Corning Glass Works in New York for six years, after which he was in charge of experimental work at Berkley for the U. S. Bureau of Mines. He had taught at the University since 1938.

Clarence E. Milner, 65, vice president of the Utah Iron Ore Corp., died Nov. 20 in Salt Lake City. He had helped introduce power shovel open-pit operations into the iron ore fields of southern Utah.

George W. Shores, engineer in charge of Allis-Chalmers crusher sales section, died suddenly Nov. 29 while in Oslo, Norway, on company business. He was 55.

Philip H. Holdsworth, 67, Seattle mining engineer, died Nov. 21 at his home.

Cyril Wigmore, mining and petroleum engineer, died in Los Angeles Nov. 3 following a long illness. He served for a number of years as chief engineer of Arizona Copper Co. He was 72.

Curtis R. Burley, 71, died Nov. 14 in San Jose, Calif. He was a retired mining engineer and had taught at the School of Mines in Fairbanks, Alaska, for 17 years.

A. H. Trestrail, 59, safety supervisor for Pickands, Mather Co. on the Menominee range for many years, died Nov. 13 at his home in Gaastra, Mich.

CHARLES E. LOCKE

In Charles E. Locke, who passed away at the Homberg Infirmary of the Massachusetts Institute of Technology, on Sept. 24, the mineral industry lost one of its leading members. But his passing meant a still greater loss to his many friends and former students who will rather treasure the memory of a man who raised friendship for his fellow and consideration of others to a fine art rarely equalled in our turbulent times.

"Charlie", as he was known to his colleagues and friends, was a native of Milton, N. H., where he was born on Aug. 29, 1874. Later, he moved with his family to Portsmouth, N. H., where he attended school in preparation for M.I.T. A year after his graduation from the Institute in 1896, young Locke was engaged by Prof. Robert H. Richards to assist him in the preparation of a book on ore dressing. This association led to a lifelong friendship; it also gave impetus to the young mining engineer's leaning for a career as an educator and an expert in ore dressing.

In 1906 Locke joined the faculty at M.I.T. as assistant professor of mining engineering, later becoming associate professor, professor, and head of the department of mining until his retirement in 1941.

During the half-century of Prof. Locke's association with the mineral industry, this country moved from a position of aggressive growth to one of undisputed leadership. Part of the credit for this development must go to Charlie Locke who contributed much to the knowledge and practice of ore dressing. Not only did he participate in the preparation of Richards' four volume *Ore Dressing*, but he wrote with him the *Textbook of Ore Dressing*, now in its third edition. He also wrote several articles and a number of extremely useful technical reviews.

In recent years Prof. Locke had made it one of his major responsibilities to keep in touch with the many graduates of the Massachusetts Institute of Technology, not only in his fields of mining and metallurgy, but in all walks of life. As secretary of the Technology Alumni Association since 1930 he did this job superbly and with true love for his fellow alumni.

Prof. Locke also kept in touch with developments in the mineral industry; he was an inveterate traveler and could truly feel at home at least anywhere on the North American continent.

Prof. Locke was a member of the American Institute of Mining and Metallurgical Engineers, and a charter member of the Boston section. He believed that all students in mining and metallurgy should join this organization as student members and continue as full members during their professional careers. He took on himself the task of informing every student and of writing him personally to join. This action typifies the man who loved detail, accuracy, and was painstakingly at work to help his fellow man.

More than others, we at M.I.T. will miss the advice and kindliness of Charlie Locke, but we know that we had no monopoly on his help for his motto seems to have been to lead a good life for which no boundary can exist.

A. M. GAUDIN

Cambridge, Mass.

H. CLARE HORWOOD

In the sudden death of H. Clare Horwood in Vancouver, B. C., on Oct. 30, his many friends and the mining industry have suffered a real and grievous loss. "Clare," as he was known, was enjoying a holiday at the coast and the news of his sudden passing was difficult to accept.

Born in Ottawa in 1905, his career and progress in the field of mining geology was direct and constant. He received his bachelor's degree in geological and mining engineering at the University of British Columbia in 1930; a Master of Science degree in geological engineering at Queen's University in 1931, and a Ph. D. in geological and mining engineering at

Massachusetts Institute of Technology in 1934.

In 1936 he was appointed assistant geologist on the staff of the Ontario Department of Mines, after gathering experience in field work with the Geological Survey of Canada in Alberta, British Columbia, Manitoba, and an interval of private practice in Great Bear Lake. During this period he also acted as assistant geologist in the Bureau of Economic Geology in Ottawa. In 1943, Clare was appointed district geologist for Northwestern Ontario, residing at Port Arthur and in 1947 was recalled to headquarters staff with the Ontario Department of Mines, Toronto. During the course of his expanding career with this department, his work took him into the Casummit Lake, Superior Junction, Red Lake, Little Long Lac and Missanabic areas, and he was very active during the war years in the strategic mineral field.

An outstanding contribution to Canadian geological knowledge is his report upon the "Geology and Mineral Deposits of the Red Lake Area" (Vol. XLIX, Part II, 1940, of the publications of the Ontario Department of Mines). Although he was the author of more than 30 other papers and articles of great interest, the Red Lake report is outstanding from every aspect, demonstrating as it does the basic knowledge of Mr. Horwood, making a clear exposition of the information so meticulously gathered, and more particularly reflecting the calm confidence which he so obviously felt in his work and the future of this area and country.

His devotion of interest is best demonstrated by briefly recounting his affiliation with this Canadian Institute, the American Institute of Mining and Metallurgical Engineers, Society of Economic Geologists, Association of Professional Engineers of the Province of Ontario and the Prospectors and Developers Association. In proper recognition of his contributions to geological knowledge, he was elected a Fellow of the Royal Society of Canada.

His wider humanities are only partially indicated by recalling that he found time in a busy professional life to be a member of the Junior Chamber of Commerce in Port Arthur, where he originated and supervised a half-million dollar community center. He was also a director of the Rotary Club in that city and a member of the Masonic order.

He is survived by his wife, a son and daughter, his stepfather, Dr. E. L. Bruce of Queen's University, two sisters and two half-brothers.

A deserved and sincere tribute was recently paid to Clare by the Ontario Minister of Mines, Mr. Frost, speaking for his colleagues and fellows. His friends and associates will always remember his sincerity, vitality, warm heart and ready smile.

CHARLES C. HOUSTON

Toronto, Can.

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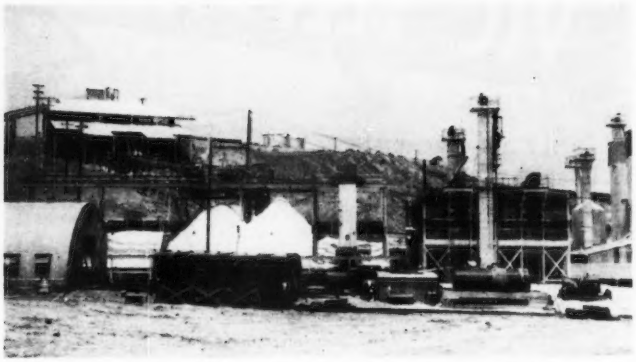
REGIONAL NEWS



THE OWENS-ILLINOIS GLASS CO. plant, Cokona, Calif., costing over $900,000, turns out more than 15,000 tons of washed sand per month. Crushed glass sand is washed in the plant on top of the hill. Primary storage bins are at the foot of the hill and drying and magnetic separator plants at right.

CALIFORNIA

Eagle Mountain iron mine producing full time for Fontana mill—Mars Metal Co. building smelter

★Owens-Illinois Glass Co. is operating its recently completed glass sand washing plant near Corona. The sand is mined by open pit methods. Equipment used in the pit consists of 18-cu. yd. Carryalls drawn by D8 Caterpillar tractors. These deliver the material to a hopper, with crushing done in a Kue-Ken crusher. Crushed sand is transported by a 24-in. belt conveyor to stockpile, whence a second 24-in. conveyor delivers it to distributor at the head of the washing plant divided into two sections. Processing involves extensive scrubbing, washing, drying, and magnetic separation. Many of the treatment units are of special design. Finished sand is shipped to the company's glass plant in Los Angeles.

The glass sand deposit a short distance from the washing plant is an arkose sand of tertiary age (probably Eocene). It is overlain by from 4 to 10 ft. of sandy clay overburden. Most of the feldspar content of the sand has altered to clay. As a consequence, elaborate washing is necessary.

★Some 300 men are now employed at the gold properties of Idaho Maryland Mines Corp., Grass Valley, Nevada County, with monthly production running between 13,000 and 15,000 tons. The Brunswick shaft has reached a depth of 3,460 ft. and active development work is in progress on the 2,300-ft. level. Stopes above the 1,600-ft. level are producing the bulk of ore treated at the Brunswick mill.

A new gold-bearing vein 30 ft. wide has been struck at the 2,700-ft. level, according to Neil O'Donnell, executive vice president and general manager of Idaho Maryland.

★Empire Star Mines Co., Ltd., Grass Valley, is operating the Empire, Pennsylvania and North Star mines on a leasing agreement, and the monthly ore production is treated at the Empire mill. The company is also operating the Dannebrog mine at Browns Valley on a limited scale, and about 45 tons of ore are treated daily at the nearby Pennsylvania mill. H. R. Fitzpatrick, general manager, is in charge of operations.

★Plant rehabilitation is under way at the drift gravel mine of Calaveras Central Gold Mining Co. near Altaville, including erection of an 85-ft. steel headframe over the main shaft and re-equipment of the nearby ventilation and escape shaft. A new gravel washing plant will be installed following completion of the headframe.

The property has been idle since order L-208. Harry Sears is president of the company.

★Mars Metal Co. has started grading for a new smelting and refining plant in San Francisco that will about double present capacity. The plant, to cost more than $100,000, will be located in Visitacion Valley and will replace the company's facilities at 23rd and Minnesota Streets. It is expected to be completed in February. Eighteen smelting units with a capacity of from 1,200 to 1,500 tons per month will handle brass, copper, lead, tin, zinc, aluminum and other non-ferrous metals. Partners A. L. Goldberg and H. F. Forster control the firm.

★Henry Kaiser's Eagle Mountain iron mine went into full operation in November when hauling started on the 52-mi. private railroad from the mine to Southern Pacific tracks at Ferrum on the Salton Sea. The total 164-mi. haul from the mine gives Kaiser's Fontana steel mill one of the shortest trips for its supply of any major steel plant in the country.

★Mountain Copper Co. is producing pyrites for use in San Francisco Bay area chemical plants at its property near Redding. The 450-ton concentrator which produced copper and zinc concentrate during the war years remains closed. A total of 75 men is now employed at the property, with 17 men on actual production underground and 10 staff members. C. W. McClung is superintendent.

OREGON

★A 20-ton furnace is being installed at the Johnson Creek mine of the Amity Mining Co. in Crook County. Underground development is being continued at the mine.

★Current Creek Mining, Inc., a company organized in Prineville, is driving a crosscut from the east side of Current Creek in Jefferson County to ascertain if an occurrence of antimony, found on the surface, exists at depth.

★F. W. Libbey, director of the Oregon State Dept. of Geology and Mineral Industries, has authorized the department to conduct a study on the feasibility of using Oregon volcanic ash in the manufacture of ceramic glasses.

★Aluminum Company of America is continuing exploration work in Washington and Columbia Counties where it has spent about $2 million exploring ferruginous bauxite deposits, according to the biennial report of Oregon State Department of Geology and Mineral Industries. This same report says the combination of a fixed price for gold and high operating costs has caused a depression in the State's gold production. Only a few dredges and a few owner-operated lode gold mines are continuing work.

★During 1948, Northwest Copper Co., Pacific Smelting & Refining Co., and Crown mine did development work underground in the Little North Santiam district, according to the Oregon *Ore.-Bin.*

WASHINGTON

Bureau of Mines considers sites for Northwest headquarters—Chromium company seeks to buy domestic ore

★Sites for the establishment at Spokane of the Northwest headquarters of the United States Bureau of Mines are being considered at Washington, D. C., according to Norman L. Wimmler, supervising engineer at the Spokane Bureau of Mines office. He made it plain that no decision had been reached, but it has long been felt by northwest mining men that the present headquarters at Albany, Ore., is too far removed from the mining districts.

★Pacific Mutual Silver Lead Co. has disclosed additional veins and ore shoots by 5,000 ft. of bulldozing, just completed at its property near Kellar, according to C. A. Gray, manager. Diamond drilling on six known veins is planned for the spring. Plans are to extend the main Mammoth tunnel about 200 ft. during the winter to add ore tonnage on the Nos. 3, 4 and 5 Bunker Hill veins. Two orebodies above this tunnel are ready to start stoping, according to Mr. Gray.

★Talisman Mining & Leasing Co., with property at Laurier, was to install a new, larger compressor which will keep the mill running the year around. A standard classifier and crusher have been purchased. The plant was reported to be running 24 hrs., 6 days each week, in November.

★The Mead ferro-chrome reduction works of Chromium Mining & Smelting Co. is offering to purchase domestic chrome ores. The price quoted, according to Leo H. Timmins, president of the Chromium company, is $21 per gross ton for ore laid down on Highway 199 (Grants Pass-Crescent City area). Minimum specifications are 45% Cr_2O_3 content, 2.5 to 1 chrome-iron ratio.

★The Mead aluminum reduction plant, which expected to close the sixth potline because of power shortage, was able to negotiate with Northwest power officials to supply 15,000 kw. every day, so about 80 pots are out and only about 40 men were laid off, according to Norman Krey, works manager. The added power is being made available by the British Columbia Electric Railways.

★The 22nd Annual Mineral Industry Institute is to be held on the campus of the University of Washington on Thursday, Jan. 20, 1949. This year the Institute, sponsored by the school of mineral engineering, will be a symposium on industrial fuels. Prominent speakers will address the gathering on electricity, coal and gas in this area. Special problems involved in the application of fuels to specific industries will be discussed.

EAGLE MOUNTAIN iron ore mine near Desert Center, Calif., will provide 90% of raw material needed by Henry Kaiser's Fontana steel plant. Production of 8,400 tons per week is expected to reach 3,500 tons daily within five months. (Wide World Photos.)

★Gladstone Mountain Mining Co. is sinking on a chimney of high-grade ore discovered by recent bulldozing in virgin ground on its property in Stevens County. Lead concentrates from a low-grade ore dump have been sent to the Bunker Hill smelter with returns of about $2,000 a car, according to an official of the company.

★Gold Syndicate Corp.'s aerial survey of its property at Orient has shown a new ore structure near the old high-grade orebody which yielded former operators over $1 million in gold and silver, according to Frank Lilly, of Spokane, president. He also reported that a ground check had shown evidence of a "big, low-to-medium grade orebody."

IDAHO

Rare Metals Co. sells first tonnage shipment of monazite sand—Nabob company purchases Jumbo group

★Golconda Lead Mines Co. has received gross smelter returns of $34,049 from the Bunker Hill smelter for 100 tons of silver-lead concentrates produced in driving a prospect development drift on the Golconda vein on the 1,000-ft. level. The concentrates averaged 72% lead and 58 oz. silver per ton and yielded 144,000 lb. of lead, valued at $28,800, and 5,800 oz. of silver, valued at $5,249.

The vein, which also enters property of Square Deal Mining Co., has now been drifted on in Golconda ground for more than 300 ft. showing a width of from 2 to 8 ft. of first class milling ore, and most of the time 2 to 3-ft. width of lead ore that will average 60% lead in the crude state.

★The Nabob Mining Co. has purchased the Jumbo group of three mining claims from George H. McKinnis and associates, of Kellogg, and the patented Lockport mining claim from H. M. Hueman, of Wallace.

★Sunset Minerals, Inc. is mining and milling 100 to 125 tons of zinc-lead ore daily from the Liberal King mine on Pine Creek. The complex ore carries principally zinc. Reserves are estimated at about 150,000 tons.

★The Rare Metals Co. has sold its first tonnage shipment of monazite sand to the Lindsay Light & Chemical Co. in West Chicago. The Chicago company has contracted for a sizable tonnage of the product, according to its president, Charles Lindsay. He reports that India and Brazil have practically embargoed shipments of monazite sand since the first of 1948.

The Rare Metals Co. operates a separation plant at McCall, where it recovers, in addition to the monazite sand, several other rare minerals and two types of commercial garnets.

★The Howe Sound Mining Co., developing a deposit of cobalt ore in the isolated Blackbird mining district of Lemhi county, has driven 1,800 ft. of underground drift and crosscut work and 780 ft. of raise work, in addition to 7,000 ft. of underground diamond drilling and 10,000 ft. of surface drilling.

★The Hope Silver-Lead Mining Co. at Hope reports that work is being pushed at the rate of 10 ft. per day on a new crosscut that will open the Elsie K vein on the 700-ft. level. The vein is producing from 65 to 70 tons of mill ore daily from upper workings.

★The Silver Syndicate mine, jointly owned by the Sunshine and Silver Syndicate companies, is producing about 1,000 tons of ore monthly.

THE 2,500-TON GOLD DREDGE of the South Platte Dredging Co., Colo., in its fourth year of postwar operation, is eating its way through the bed of South Platte River's middle fork at the rate of 14,000 cu. yd. of gravel a day—and a gold brick a week. Recently working a cubic yard of gravel for 6c. or 8c. worth of gold, it is now moving into 10c. material. The monthly payroll is $7,500. (Photo by Sanborn.)

UTAH

Kennecott contracts for 5 million lb. of lead—Shafts, headframe nearing completion at Horn Silver mine

★Kennecott Copper Corp. has awarded the contract for installation of more than 5 million lb. of sheet lead, lead pipe and other lead apparatus at its projected new copper refinery at Garfield to Andrews-Knapp Construction Co., New York City. Excavation for the new refinery was begun in November.

★Snyder Mines, Inc., has challenged constitutionality of a State Industrial Commission levy for employment security taxes to protect "lessees." The challenge was issued at a Commission hearing Nov. 29 after the uncovering of misplaced files in the case, which involves from $12,000 to $1?,000.

★Operations on 1,500-ft. and 1,600-ft. levels of the North Lily mine, Eureka, have been abandoned and the pumps pulled, Frank A. Wardlaw, Jr., president, has announced. Gold-silver-lead-zinc ores being taken from the levels had dwindled.

Work is being done on the 1,100-ft. and 1,350-ft. levels in connection with development of a leased block in property of the Eureka Lily Mining Co.

★Vanadium Corporation of America is planning to build a $50,000 mill at the mouth of White Canyon for treating complex copper-uranium ores.

Rex Smith, Naturita, engineer for the vanadium company, said plans are pending action upon two applications. One of the applications before the U. S. Bureau of Land Management is for a mill site and certain easements over public lands. The other is with the State Road Commission seeking help in snow removal over Bear's Ears pass.

If the road can be opened periodically during the winter between Monticello, via Blanding, and the mill site so construction materials can be freighted to the site, construction will get under way quickly.

★Morris P. Kirk & Son, Inc., subsidiary of National Lead Co., has opened its new $175,000 plant at 6th West and 9th South, Salt Lake City. The plant, to be managed by C. F. Duds, will manufacture non-ferrous white metal alloys including type metals and solders. It will distribute lead pipe, sheet lead and lead valves.

Morris P. Kirk, Sr., during an inspection trip, said the plant will begin on a modest scale with 20 employees.

★Metal Producers of Los Angeles, leasers of Horn Silver mine, Beaver County, are completing shafts for two-skip haulage, installing a higher head frame and bins cut underground. A heating system is being installed in the mill and the crushing plant is being rearranged for finer crushing.

★Twenty new mine cars have been delivered to the Park City Consolidated mine, Park City, where considerable development and rehabilitation work is under way. Silver-lead-zinc ore is being taken out on a face in the north vein on the 900-ft. level.

MONTANA

★On Jan. 13 the Mining Association of Montana will hold its eighth biennial legislative meeting and banquet at Helena. At the end of the business meeting, the names of the officers of the Association for 1949 will be announced. The complimentary banquet to members of the legislative assembly will be given by the mining and other industries of Montana, sponsored by the Mining Association of Montana and its Helena Chapter, the Last Chance Gulch Mining Association.

★Last Chance Gulch Mining Association held a dinner and meeting at the Placer Hotel on Nov. 30, to discuss proposed changes in the Federal land location laws. Discussions were led by Ted Collins, Helena, president of Collins Land Co. and chairman of the public lands committee of the Mining Association of Montana, and C. E. Pew, Helena attorney and member of the lands committee.

★Jay Bettles, who has taken a lease on a fluorspar prospect near Superior, Mont., from the Coeur d'Alene Mines Extension Co., reports that he is shipping fluorspar running 98% pure from open cut operations. The high-grade vein is said to be about 8 ft. in width. In addition there is a wide vein structure of lower grade material on which tests are being made for milling operations. Mr. Bettles is now driving a lower tunnel to prospect the deposit at greater depth. Eight men are employed in the operation.

COLORADO

U.S. Vanadium Corp. to buy uranium ore from independent miners—Court rules against switching charge

★Plans for the new Carlton gold ore reduction mill to be built in the Cripple Creek district are expected to be completed within 60 to 90 days. According to A. H. Bebee, vice president and general manager of the Golden Cycle Corp., construction will start early next spring. The mill will be built at Elkton, midway between Cripple Creek and Victor.

★The Rifle plant of the United States Vanadium Corp. will offer to purchase from independent miners uranium-bearing ores which are amenable to the Rifle process, under provisions of a new three-year contract between the company and the U. S. Atomic Energy Commission, the Commission's office at Grand Junction announced. Up to this time the only ores processed at the Rifle plant have been from company owned mines.

★The feldspar plant at Parkdale, Fremont County, is in operation. Mica and silver also are produced at Parkdale by Consolidated Corp.

★After a shutdown of nearly a year the Clear Creek-Gilpin mill is again in operation under lease to Arthur Portenier of Idaho Springs. Portenier is now milling ores from the Crazy Girl mine.

★Philip C. Leahy, Colorado materials manager for the U. S. Atomic Energy Commission, said in Durango that rehabilitation of the Durango smelter is now in progress. Leahy confirmed an announcement made in Washington that the Durango plant will be operated by the Vanadium Corporation of America, and added that it will be under the direction of Dennis Viles,

western manager for the corporation. Leahy also said that the ore processing plant at Monticello, Utah, (as distinguished from the ore receiving depot now in operation there) is being modernized.

★A federal court decision has stopped the Interstate Commerce Commission from requiring railroads to charge for switching ore cars at smelters. Only a supreme court ruling can reverse the district court findings. The switching charge was ordered into the ore shipment rate by the I.C.C. but the federal district court first gave a temporary delay, then a final decision against the rate.

ARIZONA

U.S. Smelting company to liquidate Gold Roads operation—Fire destroys hoist house at Crown King mine

★Officials of the newly organized Yarnell Consolidated Mines announce the proposed construction of a 150-ton daily custom ore plant in the Yarnell district.

★Operators of the Copper World mine 45 miles south of Kingman have finished the 650-ft. crosscut and are drifting both ways on a good grade of ore carrying copper and zinc. The ore will be milled in a new installation at the Boriana mine three miles distant.

★The cooperative organization operating the Mineral Park mill has purchased the Copper Age mine, between Chloride and Mineral Park. The mill is working 40 tons daily from this mine, with values in lead, zinc, and some gold and silver.

★The sulphuric acid treatment plant at the Emerald Isle mine near Chloride has been closed along with the mine. The plant has been treating copper from the open pit mining operations developed during the war.

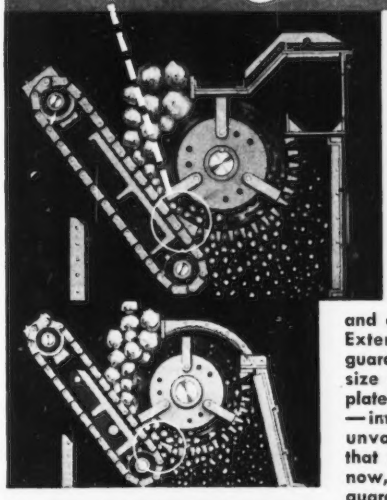
★The $15,000 hoist house of the Golden Crown Mining Co. at Crown King, 20 miles from Mayer, which was destroyed by fire last August, is being rebuilt. The undamaged 60-ton flotation plant will continue to treat the copper-lead-zinc ores from the mine.

★The Castle Dome Copper Co.'s new Red Hill orebody is expected to prolong the life of the property by two years through addition of 6 million tons of milling ore containing 0.7% copper.

★Shaft sinking operations are under way at the San Manuel Mining Enterprises operation of the Magma Copper Corp. north of Tucson, where the company has spent $1,450,000 for the drilling of more than 195,000 ft. of test holes.

A power plant has been set up and

BETTER CRUSHING BEGINS HERE!



Crushing money is saved or squandered in the "heart" of the mill...where reduction begins! That's why the headline feature of the new improved "36 Series" Dixie Hammermill is the extension of Dixie's Continuously Moving Breaker Plate*...a unique, money-saving innovation that sets a new standard of crushing efficiency.

Note by comparing before and after diagrams how the new, Extended Moving Breaker Plate guards against the passage of oversize material between the breaker plate and front cage bar. The result—improved grinding control for unvarying uniformity of product that makes the Dixie Hammermill now, more than ever before, your guarantee of greater production at less cost.

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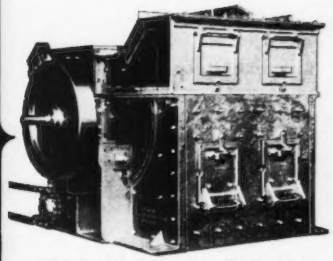
Other important changes in the new "36 Series" Dixie Hammermill include:

- 1. All-steel construction for greater strength . . . longer life
- 2. Flange type end discs of all cast steel for protection of hammer bolts and nuts from wear at ends
- 3. Convenient clean-out and inspection door
- 4. Metal trap (optional) for facilitating removal of tramp iron.



Dixie "36 Series" Hammermills, for primary or secondary crushing, are built in 4 sizes in capacities ranging from 25 to 150 tons.

*U.S. Patents Granted and Pending

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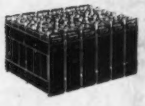
STORAGE BATTERIES



EDISON STORAGE BATTERY DIVISION

of Thomas A. Edison, Incorporated, West Orange, N. J.

In Canada: International Equipment Co., Ltd., Montreal and Toronto

Arizona *(Continued)*

a number of homes, several dormitories and a mess hall erected at the mine site. About 100 men are employed at present. A mill will be built at the site to produce and process about 25,000 tons of ore a day, according to Wesley P. Goss, general manager of the Magma company.

★Pending a ruling by the state attorney general, the Arizona Tax Commission is prepared to enter a final order claiming $350,000 in sales taxes paid by mining companies on federal wartime copper subsidy premiums. The companies paid the tax under protest. It represents assessments levied by the state on subsidy payments after supreme court rulings in other states held the subsidies taxable.

★Western Arizona Metals Co., developing the Lead Dike property in Maracopa County, recently took out a 36-in. block of ore 18 in. through which was pure galena and weighed 1,650 lb. The high-grade ore mined during shaft sinking operations ran between $400 and $500 a ton, shipping grade up to $80. Plans are to sink the shaft, now at 125 ft., to the 200-ft. level before stoping along the vein. The company will construct a small pilot mill to work out the flow sheet for a contemplated 500-ton plant.

★The Copper Butte Mining Co. is now mining and shipping 1,500 tons of copper ore monthly from its open pit operation near Ray. C. F. Mitchell is manager of the mine, which employs 16 men.

★The United States Smelting, Refining and Mining Co., formerly one of Mohave County's largest mining operators, will liquidate its Gold Roads surface plant and underground equipment, it has been announced by officials. The reasons given were the high cost of maintenance on equipment and high taxes. L. H. Duriez, manager of the company, said it was impossible to mine low-grade ore economically under the present high cost of labor and materials.

★A tax refund of $4,607 to the Eagle-Picher Mining Co. on its San Xavier group of mines was ordered by Superior Court Judge J. Mercer Johnson. The refund represents overpayment of 1946 taxes.

★The Bagdad Copper Corp., of Bagdad, hopes to increase its rate of production with an all-electric 5-yd. P&H shovel. Bagdad has been producing 90,000 tons of copper ore monthly from the open-pit section of its mine with 250 men working on three shifts.

E. R. Dickie, manager, announces that in the near future 40 new homes for employees will be built just outside of Bagdad.

★Ernest Wittenau, manager of the New Cornelia branch of the Phelps Dodge Corp., announces that authori-

zation has been given for a $500,000 improvement program to increase the efficiency of the milling plant. A 54-in. crusher to replace the present 48-in. crusher, and a new thickener, will be included in the improvements.

★Work has been started on a $120,000 wing on the Phelps Dodge hospital at Ajo in Pima County. The two-story structure will house doctors' offices and contain four private rooms, utility rooms, an obstetrics division, private and semi-private rooms, a small ward and nursery. A portion of the present hospital will be converted into a laboratory and additional rooms for the nurses' home.

NEW MEXICO

Denver company purchases fluorspar mill at Gila—Development of barite deposit under way near Hatch

★Estimates are that from 300 to 400 persons in the state are now prospecting for radioactive minerals, either on a full or part-time basis, and about 30 Geiger counters are reported to be in use. The White Signal mining district 25 mi. south of Silver City is receiving much attention. Another center of interest is the northwestern part of the state, near the deposits now being developed in Colorado.

★Dr. Dexter H. Reynolds, head of the division of research and development at the University of New Mexico, recently told members of the Albuquerque chapter of the New Mexico Miners and Prospectors Association that their state is "one of the richest areas in the world—potentially—yet it is about the most backward state in using its resources to best advantage."

Dr. Reynolds listed three reasons for lack of industry in the state: (1) poor organization of manufacturing concerns, with a resultant loss of faith in them by the public; (2) exporting of raw materials and importing of finished products, rather than manufacturing within the state, and (3) desire of the state's residents to keep it "picturesque" to insure development of the tourist trade.

★J. W. O'Brien, owner of Mudrite Chemicals, is planning development of barite deposits near Hatch. He plans to market the product as drilling mud to oil drillers in the Southwest and Rocky Mountain areas.

A new road to the deposits has been completed. Mining will be by the open-pit method, with the crude ore being cleaned at Rincon, where a concentrator is now under construction. The concentrates will be sold to other interests, which will complete grinding, bagging and marketing.

★The War Assets Administration has announced sale of the government's fluorspar mill at Gila, Grant County,

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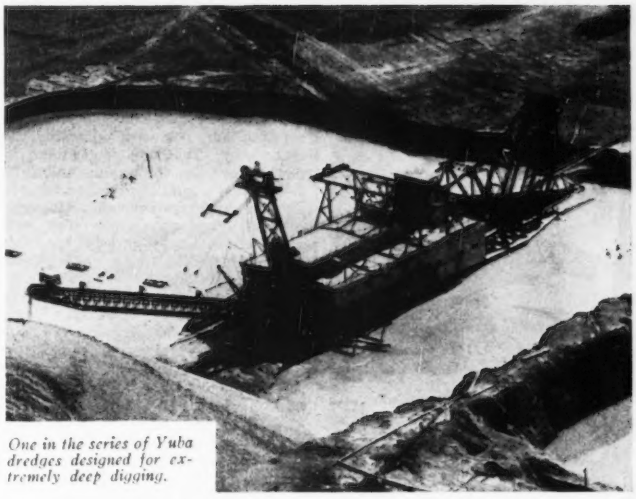

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New Mexico *(Continued)*

to the Barnett Co. of Denver. Its bid was $27,116. The sale included the mill, 11 other buildings and utilities and a 12-acre tract of land. It is located on State Highway 260, near Silver City.

TRI-STATE

★Due to the recent increases in prices received for lead and zinc concentrates by Tri-State operators to $292.17 per ton for galena and $110 for blende, a mild stimulation in production appears evident. Although producers are apparently very well satisfied with the prices received, some substantial tonnage of galena has not yet moved. The advance in blende quotation was followed by a voluntary, general 12½c. per hour wage increase. The increase was accepted generally by both union and non-union workmen. However, the union local of one major producer objected to the wage increase under the terms of its contract and demanded further negotiations.

★Shortly after the concentrating mill of American Zinc Company of Oklahoma, subsidiary of American Zinc, Lead & Smelting Co., was destroyed by fire last August, Eagle-Picher Mining & Smelting Co. acquired the 200-acre mining lease furnishing rock to the mill.

Eagle-Picher moved to the property a 500-ton steel hopper and derrick which was placed over the old mill shaft, now designated as Kenoyer No. 1. A 500-ton wooden hopper and derrick is being constructed on the shaft formerly designated as No. 8, now Kenoyer No. 2. Necessary spurs are being laid for railroad car haulage of the mine rock to the Eagle-Picher Central Mill located some three miles south of the mine workings. All tracks, trucks and cans have been removed from the mine. Necessary roadways underground are being graded and complete mechanical equipment is being installed.

Drilling will be carried on from five caterpillar-mounted, air-powered, jumbo drilling booms, the rock drills mounted on 10-ft. sash; loading by three Allis-Chalmers HD-5 caterpillar-mounted, diesel-powered portable ramps; hauling by five diesel powered 10-ton dump trucks on pneumatic tires. Hoisting will be accomplished by the usual Tri-State center pull method, using 1,500-lb. capacity cans. The diesel trucks will dump into an underground hopper from a ramp. Hoisting cans will be loaded at the hopper chutes and placed in position at the bottom of the shaft by a unique air-piston arrangement, developed by Eagle-Picher men, which slides the loaded can approximately 6 ft. on a steel plate into proper position for hoisting.

MICHIGAN

Calumet & Hecla investigates with Poor & Co. possible outlet for finely ground conglomerate sand

★In cooperation with Poor & Co. of Chicago, Calumet & Hecla Consolidated Copper Co. is instituting an experimental program which may eventually lead to a new business in the Michigan copper district. Poor & Co. has been investigating at its Waukegan, Ill., laboratory the use of finely ground conglomerate sand as an abrasive in buffing bars, deburring compounds and liquid abrasives. These items are widely used by the metal-finishing industry in preparing products for plating.

Poor & Co.'s facilities, however, are not sufficient to permit large-scale commercial testing. An arrangement now has been made for Calumet & Hecla to produce about 150 tons per month of finely ground conglomerate sand for shipment to Waukegan for blending and testing, on a commercial basis. If the tests prove successful, consideration will be given to equipping a plant at Lake Linden for production of the material on a commercial basis.

To produce the necessary dried conglomerate sand, the copper-oxide drying and bagging equipment at the Tamarack reclamation plant probably will be used.

★The secondary leaching department of Calumet & Hecla's Tamarack reclamation plant has shut down temporarily. The company has been unable to sell copper oxide as fast as the plant can produce it and has a large amount of bagged copper oxide on hand.

★Calumet & Hecla has announced that it will not dismantle or scrap equipment and buildings of the Lake Linden reclamation plant, which was recently shut down because of the exhaustion of the conglomerate tailings. It may be possible to utilize the facilities for other products.

IRON COUNTRY

November rains improve situation somewhat as to power—Hill-Annex to have Heavy-Media plant

★M. A. Hanna Co. is doing winter stripping at the Perry mine (formerly designated as H-33 Reserve), east of the Argonne mine, near Nashwauk. The lease is owned by the Hanna Coal & Ore Co. A new 12-cu. yd. dragline is being erected. The company also plans to strip at the Shiras mine, near Buhl, inactive since 1927.

★Pickands, Mather & Co. is develop-

ing a new open-pit mine in Sec. 10-57-21, directly west of the open pit at the old Leetonia mine. A forty containing very good direct-shipping ore is being stripped by a Bucyrus-Erie shovel, serviced by 20-cu. yd. Euclid trucks and working two shifts a day. Cuts are being taken from east to west, and the shovel is working on its second cut. Ore has already been uncovered in part of the first cut where the overburden is shallow. Transformer and fuel tanks have been set up and warehouse and garage buildings will soon be erected.

★At Oliver Iron Mining Co.'s Spruce mine, near Eveleth, Minn., to avoid delays when railroad cars are not available, a "surge crater" about 60 ft. deep and which will hold 25,000 tons of iron ore, has been constructed. When cars are supplied, the ore comes from the pit over a 30-in. belt conveyor 1,560 ft. long, to a loading pocket on surface and thence to cars.

When there is delay in car service, the ore from the main conveyor belt is transferred by a 7½-ft. shuttle belt to the stacker conveyor. This 500-ft. belt delivers to the surge crater, from which the ore can be dropped to a pan feeder and returned to the main belt for transfer to the surface loading pocket and cars.

★Inter-State Iron Co.'s Hill-Annex mine at Calumet, Minn., is planning to replace units No. 1 and No. 2 of its three-unit washing plant with a Heavy-Media unit that will treat the lower-grade ores in the pit on the stockpile. No. 3 unit of the plant, the last to be installed, will be left in place to handle straight wash ores. The change-over is planned for the winter of 1949-1950. Meanwhile large-scale tests on low-grade ore samples are being conducted in Jones & Laughlin's research laboratory at Negaunee, Mich., and in the ore-testing laboratory at the mine. Extensive sampling is being done in the Hill-Annex to obtain representative samples for the laboratories. Results of the tests will determine the flowsheet and equipment required for the new Heavy-Media unit.

★With completion of ore shipping for 1948, Butler Brothers Mining Co. has a busy program outlined for the winter. It includes the removal of about 4,000,000 cu. yd. of stripping: at the Patrick Group (1,000,000 cu. yd.); Galbraith Group (900,000 cu. yd.) and the South Agnew, (amount not specified) with a smaller amount to be moved at the Argonne mine.

In addition to the large stripping program, the Hoadley mine washing plant is to be dismantled and the steel, with some of the machinery, will go to the South Agnew where it will be used in the construction of a washing plant. Concrete footings for hoist, screen plant and washing plant at the South Agnew have already been poured.

The South Agnew plant hoist will be an Ottumwa, 12x9 ft., driven by a

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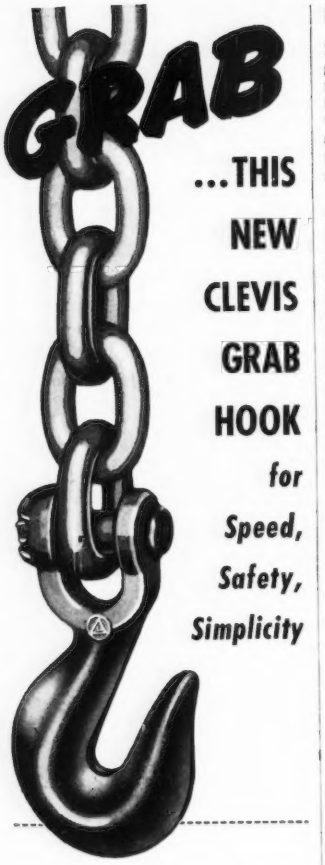

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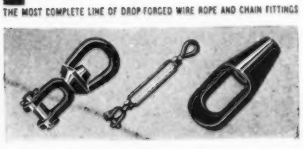

Iron Country *(Continued)*

1,250-hp. motor equipped with a speed governor, and over-travel and power failure controls. It will be installed in a separate hoist house. The hoist will operate two 25-ton skips, in balance, at a maximum speed of 1,000 fpm. The empty skips will weigh about 15 tons.

As they come from the pit up a 38-deg. incline the skips will dump directly into a screen plant located on the west side of the pit, on a 60-in. x 19-ft. reversible manganese-steel feeder. From the feeder, the ore will go to a 5x12-ft. vibrating screen. The screen's undersize will go to the washer and the oversize to a 72-in. x 19-ft. reversible manganese-steel feeder which will transfer it to a 36x 42-in. jaw crusher or to waste. The crusher product will go over a 1,000-ft. conveyor belt to the washing plant. In the case of rock, the first feeder will be reversed, by-passing the screen, the rock going to the 72-in. x 19-ft. feeder which will load it into trucks for the dump. The washing plant will contain also two 6x16-ft. vibrating screens; one 66-in. and one 78-in. classifier, a tailings pump and pickup elevator.

At the Harrison washing plant, the wooden conveyor from the surge pocket to the plant has been torn down and will be replaced by a steel conveyor truss.

★During October, 1948, 949,860 cu. yd. of stripping was moved to the South Agnew mine of which the 1150-B Bucyrus-Erie dragline moved 774,-076 cu. yd. October was again a record month for the big machine. Its yardage has been increased each month since starting with the peak reached in October. The average yardage that month was 24,970 per 24-hour day. Based on operating time, it was 29,396 cu. yd. per 24 hr. The best day in October was on the 16th when it loaded 34,770 cu. yd., or 1,316 buckets. From June 1 to Nov. 1 the dragline moved 2,990,273 cu. yd. of material.

★The First Trust Co., of St. Paul, Minn., is now liquidating the Butler Brothers' Profit Sharing Plan. Participating employees may take their credits in cash, in bonds or both.

★M. A. Hanna Co. is drilling at the old Morton mine between Hibbing and Carson Lake. The Morton is a state-owned fee property and has been idle since 1917 when it was operated by the Tod-Stambaugh Co. Its concrete shaft was sunk under compressed air, the only shaft on the Mesabi range in which "sand hogs" ever were employed, as far as we know. The Morton lease is now held by M. A. Hanna Coal & Ore Corp. The mine is credited with 2,271,308 tons of available ore.

★The Charleson Iron Mining Co. is constructing a new plant to treat lean ore, using jigs. The company has leased two large stockpiles of such ore from the state. These are located at the Missabe Mountain mine at Virginia. The piles have been in stock for some years because they are not susceptible to treatment by the ordinary washing plant. The new plant is expected to be ready for operation at the opening of the 1949 season.

The Charleson company has shipped ore from the Missabe Mountain pit steadily throughout the season, the total being about 825,000 tons. This makes a total of more than 5,500,000 tons mined and shipped since it took over the pit in 1943.

★As it has been for some years in the past, the Hill-Annex was the largest shipper of mines opened on state fees. It produced 2,375,829 tons of crude ore. The state uses crude-ore tonnages because its royalties are paid on crude ore instead of on concentrates. The state's figures, therefore, do not check with shipment figures except at those mines which ship only merchantable ore, without beneficiation which rejects any part of the crude tonnage.

The Scranton mine of Pickands, Mather was second with 1,395,905 tons.

★Although November rains were helpful, there is still an acute shortage of water for hydroelectric power production on all the Lake Superior iron ranges, both in Minnesota and Michigan. The water shortage in northern Minnesota is said to be the worst in 75 years and the situation in Michigan is equally bad.

★Jones & Laughlin's research laboratory at Ishpeming, Mich., for iron-ore experimentation under the supervision of F. X. Tartaron, is now recognized as a separate division of the company's three research departments. The others are the division of metallurgical research under Dr. H. T. Clark and that of coal and coke under C. L. Potter. Messrs. Clark, Potter and Tartaron will report directly to H. W. Graham, vice president and director of technology and his assistant, D. T. Rogers. In addition to these changes, Dr. H. K. Work, who has been supervisor of metallurgical and ore research, will be in the office of the director of technology as a staff assistant with responsibility for research planning.

★Lake Superior iron ore shipments for the season amounted to 82,937,291 tons, including 1,191,122 tons from Michipicoten and Port Arthur. This represents an increase of 5,039,204 tons over the 1947 season.

★North Range Mining Co.'s plans to dewater the Warner mine near Amasa have been delayed because of the shortage of electric power. Officials of the Wisconsin Michigan Power Co. are unable to say just when power for the pumping can be supplied but hope it will be not later than next spring. In the meantime, the North Range will do diamond-drilling to determine the extent and limits of the orebody.

ALASKA

Season ends for several dredging operations—Territorial offices to test minerals for radioactivity

★The C. J. Berry dredge, which started work early in June on Manmoth Creek, is reported to have turned 400,000 cu. yd. of gravel and to have had a better season than in 1946 or 1947. According to Harold Christensen, manager, most of the crew came into Fairbanks in October. Oscar Utgaard was dredgemaster.

★Arctic Tin Co. did two months of development work on ground leased from Tom Christensen of Fairbanks, and Joe Ramstad & Associates. The property is on Buck Creek, east of Cape Prince of Wales, and is said to be the only tin producing area in this country. Clifford Smith and Dave Browne plan to use a dragline and an elevated jig washing plant during the 1949 season.

★Nashenwing Mining Camp, on Dahl Creek near Nome, closed down in October, due to shortage of help, according to a report from Nome.

★The dredging crews of Gold Placers, Inc. on Coal Creek and Alluvial Gold, Inc. on Woodchopper Creek left the properties when the zero weather came, according to Ernest N. Patty, who reported a successful season when he arrived in Seattle, late in October.

★B. D. Stewart, Commissioner of Territorial Mines, has reported that offices at Anchorage, Fairbanks, Juneau and Ketchikan will be equipped with instruments to test minerals of the Territory for radioactivity.

CANADA

New company formed to develop Kennecott titanium—Companies report production for nine months

★Canada's output of minerals and metals (except lead and salt) in the first eight months of 1948 showed substantial increases over the previous year, as reported by the Dominion Bureau of Statistics. Asbestos was up almost 34,000 to 454,304 tons in the eight months. Feldspar moved from 22,000 to 30,140 tons and gypsum was up to 1,944,907 tons. Lead dropped slightly to 208,261,422 lb. while copper advanced from 296,000,000 to 321,049,680 lb. Gold moved from 2,000,000 to 2,287,368 fine oz. and silver made a gain to 9,750,066 fine oz. Nickel moved up from 156,187,457 to 170,528,744 lb. and zinc added 39,000,000 to show production of 309,749,099 lb.

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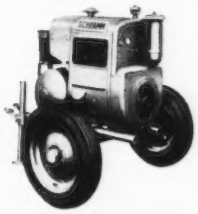
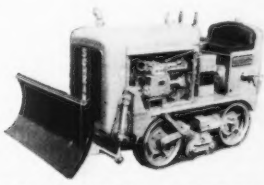


20/35 Model Compressor



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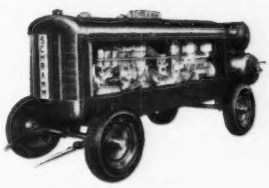
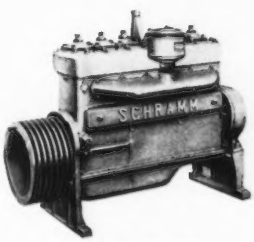


Diesel Engine Drive



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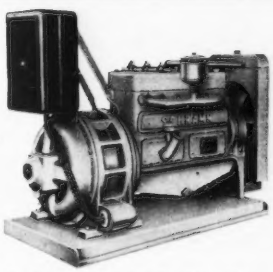

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QUEBEC

★The Quebec Iron and Titanium Corp. has been formed to develop and operate the large property located north of Havre St. Pierre, it was reported by E. T. Stannard, president of Kennecott Copper Corp. Authorized capital is $30 million. Commercial production is expected within the next three years. Titanium slag and iron for steel and foundry use are to be produced at Sorel, Que., where a smelting plant is to be built 600 miles up the St. Lawrence River from the Havre St. Pierre shipping point.

★A. O. Dufresne, deputy minister of mines, on Nov. 19 accepted a second mine-rescue truck for servicing the Northwestern Quebec mining district, with its headquarters at Noranda. The first truck was delivered earlier this year and is stationed at Val D'Or. Both are fully equipped rescue stations serving as six-patient ambulances and are complete with testing laboratory, maintenance shop and traveling classroom.

★The Quebec Department of Mines reports that gold output at the Noranda mine averaged $4.87 per ton for the first three quarters of 1948, down from the average of $5.84 a year ago. Total volume of gold produced by Noranda in the nine months was $3,380,370.

★The general manager of Siscoe Gold Mines, R. G. Walsh, has reported gold recovery valued at $473,445 for the first ten months of 1948. The grade averaged $8.82 per ton compared with $10.69 for the same period in 1947.

★New Marlon Gold Mines, located in Beauchastel and Rouyn townships, started production in June, 1947, using the Francoeur mill. The ore is trucked 12.5 miles from the New Marlon mine. The grade reported for the first quarter of 1948 averaged $7.33 per ton and in October was up to $8.38 from the treatment of 5,110 tons at a daily rate of 165 tons. Including the cost-aid allowance, October revenue was estimated at $42,800.

★Harry E. Sparks, manager of O'Brien Gold Mines, reports a 25% improvement in production for the first nine months of 1948 compared with the same period in 1947. Output averaged $18.67 per ton from 43,422 tons milled, up from $15.79 the previous year. The company operates a 200-ton mill and ships arsenic concentrates to the Deloro smelter.

★Production for Malartic Gold Fields as reported by the Quebec Department of Mines, amounted to $1,509,480 for the first nine months of 1948. This was a substantial gain over the previous year. The grade averaged $7.13 per ton. John Metz, general manager, reports the new 750-ton mill located at the No. 2 shaft has been placed in regular production, with capacity to be doubled after the old mill has been moved from the No. 2 shaft to the new mill building.

★Sladen-Malartic Mines reported lower production for the first nine months of 1948, valued at $429,345 from 156,847 tons. Grade dropped from $3.80 to $2.73 per ton. The property is equipped with a 700-ton mill which had produced a total of $8,193,400 to the end of Sept., 1948.

★Gold recovery at East Malartic Mines was reported by D. M. MacLean, manager, at $974,810 for the first nine months, down from $1,100,050 in the 1947 period. Recovery averaged $4.46 per ton compared with $6.23 in the previous year. Located east of the Sladen mine, East Malartic has carried development down to the 10th level at 1,570 ft. The No. 4 is the main operating shaft. The property is equipped with an 1,800-ton mill. Through September the total output was valued at $20,391,935.

★New Calumet Mines for the year ended Sept. 30, 1948, reports net profit of $909,369 after all deductions including income tax. In the previous year profits amounted to $377,065. The ore grade averaged $16.76 per ton for 193,647 tons.

ONTARIO

★Edwin L. Miller, president of Wright-Hargreaves Mines, reported at the annual meeting, "it is much too early and far too little work has been done to form any constructive conclusions" regarding the new deep levels. Increased operating costs have made necessary a reduced dividend. Mill capacity is 1,250 tons. Since production started in 1921 a total recovery valued at $114,840,279 was reported to the end of May, 1948.

★International Nickel Company of Canada and subsidiaries for the first nine months of 1948 showed net profit of $29,920,873, up $6,400,000 from the previous year. Robert C. Stanley, chairman and president, reported net sales in the period advanced to $141,206,106 and working capital moved ahead to $151,244,978. Assets gained more than $15,000,000 to a total of $325,218,449 against current liabilities of $28,300,000.

★The Westland Mining Co., Toronto, has acquired a 500-sq. mi. prospecting concession in the Gilbert Bay area of Labrador, from the Newfoundland Government, according to a Canadian Press release. Government assays of samples are reported at 51 to 52% iron, 10% titanium, with some phosphorus and sulphur.

The concession has been optioned by the Westland company to a group of Canadian and American steel interests who were scheduled to start work in December.

MANITOBA

★Sherritt Gordon Mines, Ltd., reports third quarter earnings to be the highest to date. Net profit is shown as $520,661.00 for the three months ending Sept. 30. Production continued

at the same rate as the first half of the year.

At Sherritt's Lynn Lake property the EL shaft was sunk to a depth of 50 ft. and the concrete poured for shaft collar and foundations for the headframe and sinking plant. Sinking is to be resumed when "A" shaft is completed to a depth of 1,000 ft. Several holes were drilled in the vicinity of the EL orebody for use in the development of deep hole geophysical apparatus. A number of short intersections with copper-nickel values were obtained in these holes.

★San Antonio Gold Mines, Ltd., reports an operating profit of $354,803, exclusive of taxes and depreciation for the first 40 weeks of the current year, on 115,571 tons of ore treated. For the same period in 1947, 109,892 tons of ore milled gave an operating profit of $483,525.00, or $4.40 per ton against $3.07 per ton this year. Development work on the lower levels is proceeding satisfactorily.

★Jeep Gold Mine, subsidiary of San Antonio, has intersected high-grade ore across six inches at a depth of 550 ft. The ore is said to be comparable to that being milled on the 325-ft. level.

★Central Manitoba Mines, Ltd., in its annual report for the fiscal year ended Aug. 31, 1948, reports that further diamond drilling is planned at its Ospwagan Lake property in Northern Manitoba. Nine holes were drilled through the ice last winter and low nickel values were encountered. Nothing of commercial importance was outlined. The company's claims at Hughes Lake have been dropped.

★Ogama Rockland Gold Mines, Ltd., reports production during October of $59,482.00 from 4,223 tons milled. The second shaft on the property has been completed to a depth of 275 ft.

SASKATCHEWAN

★Premier T. C. Douglas announced late in November that about one million dollars was assured for development of the newly discovered Black Lake uranium fields 16 miles east of Stony Rapids. Assent was to be given by the Department of Natural Resources for the assignment of the Black Lake uranium concession, known as the TR block, to a new company to be formed by Transcontinental Resources, Ltd. The Transcontinental company agreed to place $50,000 in the treasury of the new company for next season's work and to provide additional monies as required up to one million dollars. The concession terms require expenditures of $10,000 during the first year, $15,000 in the second and $25,000 in the third.

The TR concession block was originally granted to prospectors LeRoy A. Tobey of Meota and his partner, John Albrecht of Stony Rapids, to cover discoveries of native pitchblende made last August under the Saskatchewan Government's assistance plan.

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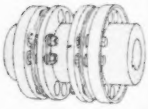

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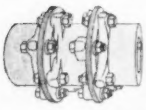

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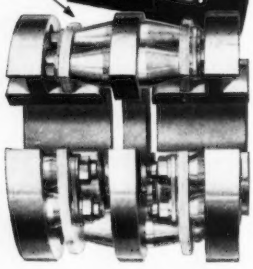

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Saskatchewan *(Continued)*

The showings were subsequently opened up by a limited amount of trenching and stripping for over 2,000 ft. Lengthy sections of the zone are estimated to contain about 0.5% uranium oxide over mining widths equivalent to $27.50 per ton. Shorter lengths of material grading up to 29% uranium oxide are present, according to the Saskatchewan Government report.

BRITISH COLUMBIA

★Canadian Exploration, Ltd., was to increase mill production at the Emerald mine from 250 to 350 tons daily by the end of the year when replacements and additions to the plant were to be made. A new sub-station is being erected at the mine by West Kootenay Power & Light Co., Ltd., to double the power supply. At present the mill is treating about 7,000 tons monthly, and producing a table concentrate grading from 70% WO_3 upwards, and a flotation concentrate which after acid retreatment yields better than 60%. A new level has been opened at the 3,800-ft. elevation and will be connected with the main haulage level at 3,950 ft.

★An increase of 2c. per lb. for zinc which followed a similar 2c. boost recently in the United States to 17½c. East St. Louis, was announced by Consolidated Mining & Smelting Co. in its reports of customs shipments for the period ending Nov. 20. In the 4-week period to that date shipments to lead and zinc plants at Trail totaled 11,676 tons, compared with 8,970 tons in the previous 4-week period.

★Brooklyn-Stemwinder Gold Mines, Ltd. was to start production at its copper-gold mine in the Phoenix camp near Greenwood in December, following arrival of a compressor. Mill feed will be drawn from the first two levels while work proceeds in clearing out two more of the old workings. High grade ore will be drawn from the new section developed by the company since the end of the war. The company has acquired a 70% interest in the old McArthur mill at Greenwood, with an option giving the right to acquire the remaining 30%. It is planned to bring tonnage up to full capacity of the 75 to 80-ton plant and as soon as development warrants to increase mill capacity, Edward Kellner, managing director, said.

★Torbrit Silver Mines, Ltd. was slated to start production with its 300-ton mill at its property near Alice Arm, Portland Canal district, by the end of the year. New installations include a hydroelectric power plant. Torbrit, whose 900-acre property is financed by Mining Corp. of Canada and Britannia Mining & Smelting Co., is considering a new low level tunnel to extend under the orebody. Ore reserves are estimated at 670,000 tons, grading about 19 oz. silver per ton.

★Santiago Mines, Ltd., which is shipping ore from its Bosun mine in the Slocan district to Whitewater Mill at Retallack, has concluded an agreement with Ramsen Financial Corp., Toronto, whereby $261,000 will be made available to Santiago's treasury, R. Crowe-Swords, Santiago president, said. Completion of Bosun's mill has been delayed by steel shortages. Meanwhile, on the basis of Trail smelter returns, Bosun concentrates from 5½ tons of milling ore are running, for lead, 67% lead and 120 oz. silver, with gross value of $379 per ton; and for zinc concentrates, 55% zinc and 70 oz. silver, with gross value of $245 per ton.

★A double swap is under way in the Adams Plateau area, Kamloops Mining division, involving the Solloway and Consolidated Mining and Smelting interests. Consolidated has taken an option on the Mosquito King group of 75 silver-lead-zinc claims between Shuswap and Adams lakes, held by I.W.C. Solloway and associates, and the latter have in turn purchased the Lucky Coon and adjoining groups, also on Adams Plateau and about 4 mi. northwest of the Mosquito King. The intervening ground has been largely staked by Pioneer Gold Mines, Ltd.

In the first deal the Consolidated company has made an undisclosed cash payment, and has entered into an agreement to spend not less than $25,000 in 1949 on diamond drilling and surface work. In addition, the company is building six miles of road to the property. The Solloway interests, in purchasing the 31-claim property including the Lucky Coon, King Tut, Speedwell and Donnamore properties, have made a down payment of $5,000 on a total price of $225,000. The property is reported to contain high-grade silver-lead-zinc showings across narrow widths.

★In the Slocan, Kaslo Silver Lead Co. was preparing the Index mine for early shipping of ore to Trail smelter. Following building of tram bunkers and laying of track throughout the 808 ft. of the main haulage level, the company will drive a raise on the vein to open virgin ground above the main haulage level. Later a crosscut will be driven from the lowest adit to intersect any downward persistence of the vein.

★Kenville Gold Mines, Ltd., which reported in November an operating loss of more than $67,000 during the past year on the mining of 19,000 tons of ore might force the closing of its Nelson district operations, is continuing to operate its mill at 130 tons a day, with ore in sight for a considerable period. It is actively searching for base metal properties to enable it to close down its gold mine should that appear advisable after the turn of the year. Two prospects in the Kootenays are under consideration. The company may also contract to mill ores from base metal properties in the

area. The mill could handle up to 200 tons daily of base metal ores, officials state.

★Base Metals Mining Corp. reports a new high for the year at its property of Field, B. C., with an operating profit of $71,000 from 3,376 tons of ore during November, compared with $56,809 from 2,224 tons in October. During November 198 tons of lead concentrates and 492 tons of zinc concentrates were produced, with four cars of lead concentrates and nine of zinc shipped to Trail smelter, according to Chamberlin Management Corp., Ltd., in charge of operations at the property. October production of concentrates was 186.97 tons lead and 377.67 zinc. Exceptionally high-grade lead-zinc ore has been developed in the Monarch mine section in the 200-C stope, with the high-grade 200-B stope now being opened.

★At the Unicorn mine on the Salmon River, Portland Canal district, No. 3 tunnel was extended 30 ft. during the late summer and early fall. Objective is the intersecting of the "A" vein which has a width of 40 ft. on the surface. A channel section from 10 ft. on the footwall in an open-cut assayed $2.80 gold, $3.40 silver, 5% lead and 1.2% copper. Channel samples from another cut showed $2.80 gold, $3.55 silver, 4.3% lead and 1.1% copper. From the typical samples the management anticipates ore valued at about $30 a ton, John Hoyland, manager, said.

★Cariboo Gold Quartz Mining Co., Ltd., which has installed a new hoist and skip at its mine at Wells, has boosted ore handling to 200 tons daily from its 150-ton daily milling basis. Services of several new experienced miners have been secured.

★Violamac Mines, Ltd. reports uncovering high-grade silver-lead ore in a new vein on No. 4 level at its Slocan district operations. Initial drifting disclosed 2 to 3 ft. of solid galena along a drift length of 9 ft., and 20 tons of lead ore worth about $300 a ton was recovered. The new vein runs east-west, contrary to the north-south strikes of former producing veins. It was reached after advancing the old workings a distance of 40 ft.

★Utica Mines (1937) Ltd., silver-lead-zinc producer in the Slocan district, proceeding with its underground program after delays due to difficulties with the compressor, has reported that the fifth level crosscut has picked up the West vein at 82 ft., with prospects of milling grade tonnage across good widths.

★Silver Standard Mine, New Hazelton, which started milling operations Sept. 29 with a 75-ton unit, reached an average of 48.5 tons daily in the first month, operating 27.6 of a possible 30 days. In November it reported the mill handling better than 55 tons daily with a calculated overall recovery of 96%.

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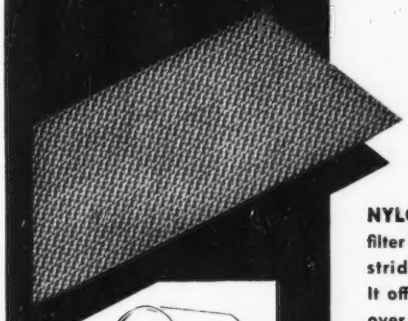

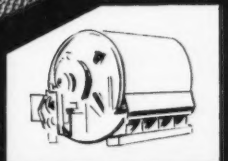

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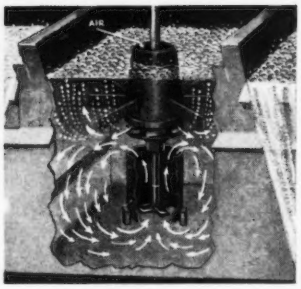

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British Columbia *(Continued)*

★Some 600 miners at Britannia Mining & Smelting Co., Britannia Beach, have accepted an offer bringing pay rates to $10 daily, including four 25c. bonuses based on the price of copper. The basic rate was raised from $8.35 a shift to $9.

★At Copper Mountain, union officials recommended acceptance of a wage boost that would bring shift pay to $10, including bonuses, offered by the Granby Consolidated Mining & Smelting Co. after miners rejected a 25c. per shift boost to $9.60.

★In another dispute, a cost of living bonus of $1 daily for one year, retroactive to Sept. 1, has been unanimously recommended by a provincial conciliation board for employees of Canadian Exploration Co., at Emerald Mine, Salmo.

YUKON

★Yukon Gold Placers' dredge on Clear Creek was to shut down late in November, according to E. N. Patty, president. Preparatory work continued on Thistle and Henderson creeks during 1948. The Thistle Creek dredge is an all-steel pontoon type with 4½ cu. ft. bucket capacity. It will be completed early this spring. Mr. Patty reported that three dredges will operate during the 1949 season.

★Yukon Consolidated Gold Corp. operated seven dredges in 1948 and will have eight this season, according to MacLeod White. The company's season is from April to mid-November with gold production usually starting in May. About 550 men are employed.

Mr. White said that dredges formerly costing $400,000 would now cost $750,000 but the operation continues profitable, grossing about $1,350,000 a year. Some 16-cu. ft. buckets are used and dredges go as much as 58 ft. into bedrock. About 14 ft. of frozen silt must be washed away to reach pay ground. Cold water has proved more efficient and cheaper in thawing the ground than steam.

NORTHWEST TERRITORY

★Consolidated Mining & Smelting Co. reported the Campbell shear has been intersected in the east drive on the 2,300-ft. level of the Con mine at Yellowknife. A gold-bearing shear has been cut, and preliminary assays show about 0.5 oz. gold per ton. The drive is continuing across the remainder of the Campbell shear.

★Negus Mines, Ltd., operating at Yellowknife Bay, Great Slave Lake, lists September gold production at $80,000 plus $10,000 in concentrates, and an estimated $8,000 to $10,000 receivable under the government aid plan. Production for July and August equalled that of September, indicating annual output of $1,080,000 without government aid.

MEXICO

National Railways to increase passenger and freight rate—Geologist reports tungsten, molybdenum find

★While the mining industry continues to urge the Government to exempt it from the new additional 15% ad valorem tax on exports, further unpleasant news for miners was received. National Railways, the Government-operated railroad that is Mexico's largest, announced its intent to increase freight and passenger rates 30%, presumably on Jan. 1.

Some mining men are predicting that the industry will get around the railway freight increase as have some other shippers by using the much cheaper, and in many cases swifter, truck lines. More and better roads favor trucking, and trucking and interurban buses have become serious competition for the railways. Mining was hard hit by rail freight increases up to 50% that went into effect on Jan. 1, 1946.

★Uranium ore in Mexico, mostly in Chihuahua, will remain unexploited for the present. Geologists assigned by the Ministry of National Economy to examine these deposits reported they are good but that exploiting them will be very expensive. Federal troops have been guarding the deposits for some time.

★Discovery of important deposits of tungsten and molybdenum in Leon municipality, Guanajuato, were reported by Ing. Vicente Andrade Pliego, Mexico City geologist who made an extensive examination of the region. He has filed claims and is arranging to organize a company for exploitation of these metals, vital to Mexican iron and steel works.

★Another general mining strike is threatened. Information in labor circles is that the miners' union is disgruntled because representatives of 90% of the companies operating in Mexico, with Ing. Gustavo P. Serrano, president of the Mexican Mining Association, as spokesman, told the union representatives during talks at the Labor Ministry that the companies won't raise their pay "another centavo." The miners ended contract revisions featuring wage increases averaging 20%, and several strikes, last spring shortly before the monetary devaluation. But leaders insist more money is imperative because of inflated living costs.

★A bright spot in the mining picture is the announcement by President Miguel Aleman that small mining will enjoy a Government subsidy of about 10 million pesos ($1,515,000) yearly in the form of exemption from half of the taxes which it now pays. The subsidy will, naturally, vary from company to company, depending upon the volume of production.

GUATEMALA

★The chief mining operation in Guatemala is Roberto Fanjul's Compañia de Minerales Nacionales, which is exploiting copper, lead, silver and gold in small quantities in Mataquescuitla and Huehuetenango, financed by Guatemalan capital. Two or three other companies are exploring the Guatemalan territory and apparently have found lead and zinc, but as they have not been granted a license to exploit these mines they will not disclose any facts.

★The Compañia Minera Guatemalateca, exploring the region around the city of Coban for the past two years, has discovered lead, zinc and silver at San Juan Chamelco. The company has recently been granted a license by the Government of Guatemala to exploit these mines, and preliminary work has started. Guatemalateca is planning to install its own smelter and build a highway from the mine to San Juan Chamelco (about 20 kilometers, or 12.5 miles).

BRAZIL

Commission says 40 million tons iron ore yearly possible—Discuss capital, transportation, ports

★Brazil's experts think the country, which exported less than 200,000 tons of iron ore in 1947, can ship 40 million tons annually if a development program is carried out. The ore would come from known fields in the state of Minas Gerais. There may be some 15 million tons of varying qualities there, although only a small part has actually been proved.

The big-scale production plan depends on building new railways and ports as well as vastly improving existing mining and transport facilities. The program would cost over $300 million, the Brazilian specialists estimate.

The plan has been laid before a group of American government experts, headed by John Abbink, chairman of the board of McGraw-Hill International Corp., who are looking over Brazil's economy.

The Brazilians, in discussion with the Americans in the Joint U. S.-Brazil Technical Commission, have indicated their hope that the capital will come from the U. S. The Abbink group, while fully agreeing that Brazil should expand her iron ore output to the maximum, is reported to have made two basic points in reply to this and other questions of Brazilian development:

1. Many expenditures within Brazil can be financed internally.
2. Where foreign financing is necessary, capital should not be ham-

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Brazil *(Continued)*

strung, and the Joint Commission should not lay out specific terms which might impede direct negotiations with foreign investors.

That has been a major point of disagreement in the Commission's meetings, the Brazilians seeking to get the Americans' approval of certain conditions which the Americans believe better left for specific discussion by the interested parties.

Two sections of Minas Gerais are involved in the project for full exploitation of the iron ore: the region reached by the Victoria-Minas Railway, with its outlet in the state of Espiritu Santo, north of Rio de Janeiro, and the area reached by the Central do Brasil Railway, which runs into Rio.

For the Victoria-Minas Railway zone, the Brazilian experts make the following points:

1. The Companhia do Vale do Rio Doce, a Brazilian government company with U. S. Export-Import Bank help, hopes to be exporting at a rate of 1,500,000 tons a year, beginning some time in 1950. Rio Doce ore comes mostly from the famous Itabira mine, about 375 miles from the outlet port of Victoria. Total investment in this project has been the equivalent of about $75 million.

2. Another 1,550,000 tons could be exported annually by this same route if some $17 million are spent on the mining, railway and dock installations; this could be done in three years.

3. By spending $175 million, however, exports of iron ore and its products from the Itabira region could be stepped up to 30,000,000 tons a year. This project involves rebuilding the whole railway with broad-gauge instead of narrow-gauge track, with the sea-terminus at Ara Cruz (formerly Santa Cruz), north of Vitoria; construction of a big ore dock at Ara Cruz, and thorough equipping of the mines. The Brazilians say the job would take five or six years.

For the Central do Brasil Railway area, the Brazilian specialists predict a possible export of 10,000,000 tons a year, which they say could be attained in two or three years. Expenses involved would be some $9 million for port facilities, $12 to $16 million on the Central do Brasil track and $27 million on rolling stock. The plan provides that the port might be Rio de Janeiro or the little town of Itacurussá, south of Rio; in the latter case, a spur would have to be built from the Central's present line, which passes nearby.

One point on which the Brazilian and American experts are reported to have tangled was a specification by the Brazilians that Brazilian ships should carry part of the iron ore exports and part of the coal or coke which would be brought to Brazil. The Americans pointed out that in a competitive world market, buyers might find that specification a disadvantage.

CHILE

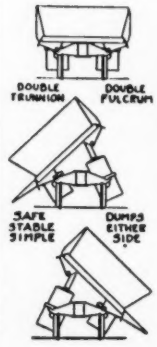
Copper flotation mill at Til-Til nearly complete—Caja receives additional supplement of $3 million

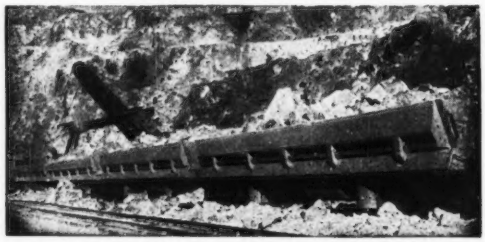
★Congress has approved an additional supplement to *Caja de Crédito Minero* of 90 million pesos (about $3 million) for the present year. Of this total, 30 million pesos will be for the Paipote Smelter and 12 million pesos to enlarge the existing cyanide sections of *Caja's* mills.

★The 900-ft. wharf recently completed for Cia. Acero del Pacifico in the San Vicente Bay south of Talcahuano is equipped to unload iron ore at the rate of 850 metric tons per hour.

★The President sent a bill to Congress authorizing Corporación de Fomento (Chilean RFC) to apply for loans up to $100 million from the Export-Import and the International Banks.

★The results obtained with the new nitrate mechanical loading plant at the port of Iquique have been so sat-





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isfactory that a similar plant is contemplated for the port of Tocopilla.

★At the present rate, *Caja de Crédito Minero* will buy this year about 280 million pesos ($9 million) in copper, gold, lead and silver ores and metallic gold, against $6.7 million last year.

★Cía. Minera Los Amigos has its 50-ton copper flotation mill almost ready to operate. The mill, built with a loan from *Caja*, is at the copper-gold mining camp of Til-Til near Santiago.

★Mr. Sali Hochschild, well known Chilean mine owner, is in the States buying machinery to mine and mill 125 tons per day from the Delirio mine of Cía. Minera Delirio de Punitaqui. Ore runs 3.5% copper and 0.13 oz. gold per ton.

★The owners of Chilean mills and lessees at the Anacollo gold camp are asking *Caja de Crédito Minero* for a loan to put up a new 1,000 hp. diesel-generator group. *Caja's* power plant at this camp now has 1,000-hp. diesels installed but the capacity is not sufficient to cope with increased mining and milling activity of the camp. Gold ores down to 0.1 oz. of gold per ton are being mined and treated by amalgamation.

★The gold law vetoed by the President has now become law after Congress approved the amendments proposed by the President. (E&MJ, Dec., 1948, p. 146.)

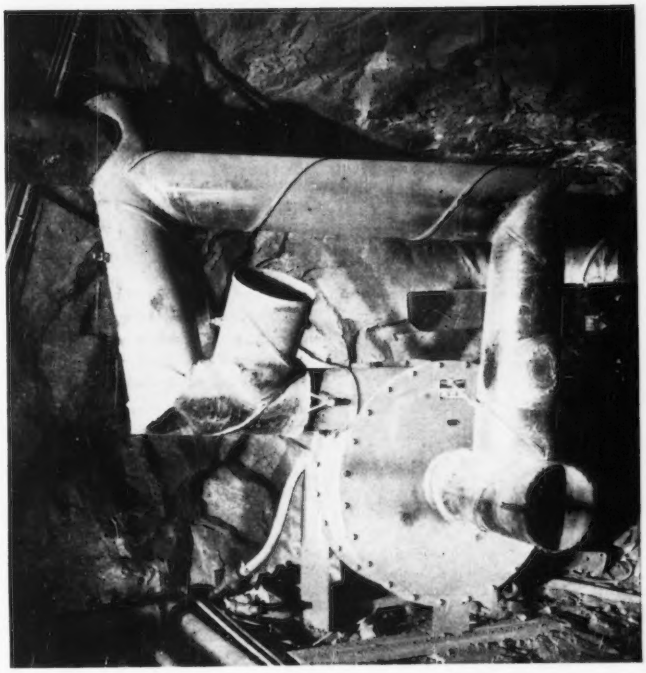
PHILIPPINES

Benguet-Balatoc may get Masbate milling equipment—Mindanao pumping capacity taxed by increased flow

★Normal operations were reported at the Benguet-Balatoc mines in October after the strike interruptions in September. Production was $252,000 from 37,800 tons milled averaging $6.65 per ton. An increased amount of development ore caused a drop in mill heads of about 90c. a ton. It is hoped to get mill capacity up to 1,700 tons daily soon. Negotiations are in progress with Soriano interests to obtain equipment from the big Masbate Consolidated mill. This was virtually undamaged during the war, but has not resumed operations on account of the low grade of its ore.

★October production at the Atok-Big Wedge mine was $187,200 from 12,617 tons, averaging $14.80 per ton. Grade milled during the month was much better than in September. Sinking of No. 2 shaft had advanced 75 ft. below the 700-ft. level by the end of October. The company declared a final year-end dividend of 1c. per share, making a total of 5c. for 1948. Application will be made to list the stock on the San Francisco Exchange.

★Lepanto Consolidated continued its



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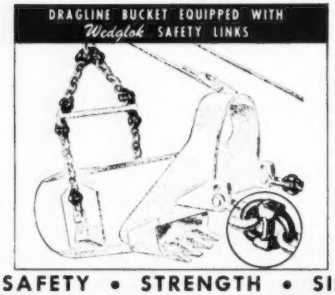

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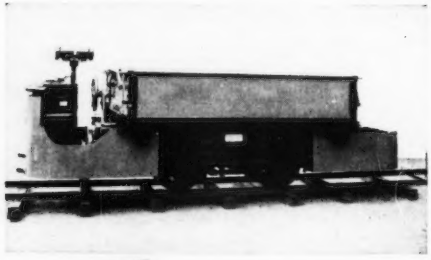

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Philippines *(Continued)*

excellent progress in October. Production for the month came to $212,500, placing this copper-gold producer second only to the Benguet-Balatoc operation in the gross value of its output. For the first half of the month daily tonnage milled was 284 and average grade of ore 6.05% copper and 0.15 oz. gold per ton. Additional flotation cells are being installed. This will permit the mill to reach its rated capacity of 500 tons per day. The labor situation is satisfactory, aided by the company policy of employing Filipino *capataces* for the mine and using a minimum of American supervision.

★October production at Mindanao Mother Lode mine continued disappointing. Although the mill ran at normal capacity, the grade of heads declined to $10.50 per ton, a drop of $3.50 from September, and of $16 from January, 1948. This was explained as due to an increase in the flow of water on the 700-ft. level from 1,300 gpm. to over 3,000 gpm.

Pumping capacity designed for 1,400 gpm. with equal standby units was overtaxed. Temporary failure of one unit necessitated closing safety doors on the 700-ft. level which cut off production for a week. The company has ordered replacement and additional pumping units. The development program on the 850-ft. and 1,000-ft. levels has to be re-scheduled. This will postpone the date when the high-grade ore zone will be reached. The unexpected flow of water has been ascribed to a severe earthquake on Sept. 3 which was followed by sharp tremors over a three-week period. A so-called acid-proof bronze pump failed to handle the highly acid mine water satisfactorily and will have to be replaced with stainless steel.

★Surigao Consolidated's mill has been recovering about 90% of the values by flotation and tabling, and between 96 and 99% by cyaniding the flotation and table concentrates. October production was over 8,000 tons of $10 ore.

★Consolidated Mines shipped 20,000 tons of chromite to the United States in October. A contract has been closed for 2,000 tons a month to England. The first shipment of 5,000 tons from Acoje was completed, and a second shipment was scheduled for the end of November.

★Mining has started at the property of Philippine Iron Mines, Larap, Paracale, by Soriano interests. They expect to ship 200,000 tons to Japan the first year. When this is under way, work will be resumed at Samar and at Batakalani.

★Work at the Taysan gold mine is proceeding well. All labor trouble has subsided. Diamond drilling is in progress and the vein continues in depth. Spectacular samples have been obtained in sinking a winze.

AUSTRALIA

British Aluminium Co. presents plan on aluminum project—Joint pension fund to aid Broken Hill employees

★The 10,600-ton-a-year aluminum refining project now being developed by the Tasmanian Government with the assistance of the Dorr Co., New York, may be revised to accept proposals by the British Aluminium Co.

The English concern is willing to set up a 100,000-ton-a-year plant. The new plan would abandon reliance on Australia's scant bauxite and hydroelectric resources and the development of bauxite deposits in the Solomon Islands, with a possible hydroelectric power system in New Guinea.

The State Government of Tasmania is loath to withdraw from the original plan unless the final processing is to take place in the island, because a hydroelectric power station for the refining of alumina is already under construction.

VICTORIA

★ Argus Hill Chewton Gold, N. L., one of the mines that recently qualified for a grant from the State Mines Department, is sinking its main shaft 150 ft. because of disappointing yields from the spur system on which it has been operating. About 136 ft. have been completed, to a depth of 456 ft. A crosscut will be driven to the eastern leg of the reef which was successfully worked in the Francis Ormond mine from 400 ft. to 1,000 ft.

TASMANIA

★Aberfoyle Tin, N. L. nearly doubled its profit for the year ended June 30. During the operating year the Australian tin price was successively raised from £380 to £555 a ton, but remained substantially below world parity. Sales of tungsten concentrates, which are not subject to price control, helped to bolster profits. The firm realized £43,726 for 83.4 tons of wolfram.

★Extraction of ore for treatment by Mount Lyell Mining & Railway Co., Ltd. decreased in the year ended Sept. 30. Production of blister copper fell from 8,273 tons to 6,556 tons, but returns for recent months indicate a renewed upswing.

★Sir Walter Massy-Greene, speaking to stockholders of the Electrolytic Zinc Co. of Australasia, Ltd. forecast a growing unwillingness by mining concerns to sell their concentrates for Australian consumption, because of the fixing of the Australian zinc price far below world parity. Actually, domestic sales of refined zinc jumped from 28,500 tons in 1945-46 to 48,225 tons in 1947-48, or from 35% of total production to 64%.

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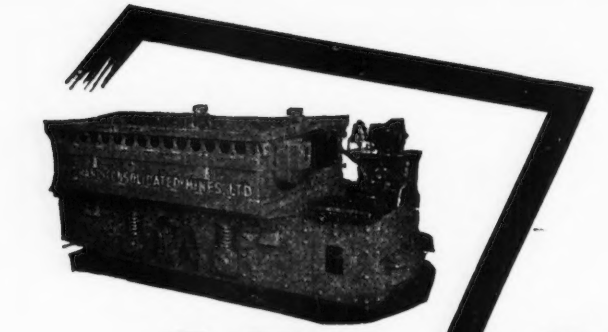

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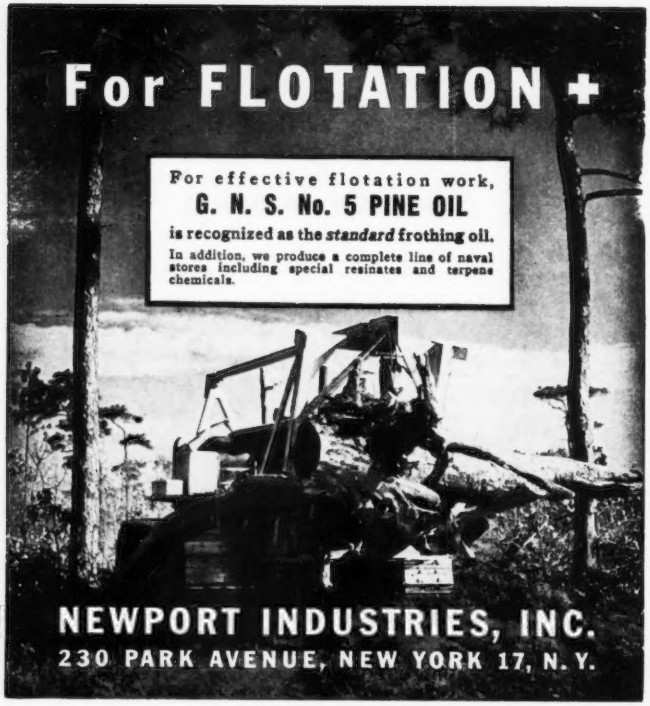
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Australia (*Continued*)

Electrolytic Zinc's own production of zinc concentrate amounts to 42,000 tons a year, equivalent to only 18,000 tons of zinc.

The Risdon refinery has now a capacity of 197,000 tons of concentrate, sufficient to produce 85,000 tons of zinc a year. The balance of concentrate must be bought from mainland mines. Towards the end of 1949 the capacity of the plant will be stepped up to 100,000 tons of zinc, for which 232,000 tons of concentrate will be required. The current annual production of zinc concentrate in Australia is about 370,000 tons. Consumption in Australia now runs 50,000 tons in terms of refined zinc, for which 116,000 tons of concentrate are required.

NEW SOUTH WALES

★Sums totaling £1,764,810 are being contributed by the Broken Hill mining companies to a joint pension fund to give the recently announced superannuation plan a good start. The current cost of the plan is met by a contribution of five shillings (80c.) a week from each male employee over 18, with a like contribution by the companies. The supplementary contribution of more than £1,750,000 will meet the cost of past services and it will be provided by the mines in ten annual installments.

More than 5,600 employees will benefit from the plan. They will retire at the age of 62 with a uniform rate of pension for life, irrespective of length of service. Additional pensions will be paid for a wife and dependent children. Widow and children will also receive the pension in the event of the employee's death either before or after he reaches 62. Similar pensions will be paid to disabled miners. The surrender value of the insurance will at all times at least equal the sums contributed by the employees.

★Of the total lead produced by Broken Hill Associated Smelters, Port Pirie, in the year ended June 30, 76% was exported. Of this exported tonnage, 76% was shipped to Britain, 15% to the U. S.. The Port Pirie smelter is the only source of refined lead in Australia, and the output of the Broken Hill mines is its only source of concentrates. The lead is sold to Australian consumers at the fixed price of £22 a long ton, about £115 less than world parity. Under the stimulus of the artificially low controlled price there is an increasing demand in Australia for lead in applications which are considered wasteful overseas at present quotations. While a considerable proportion of lead used in other countries is derived from scrap, Australian industries depend almost solely on newly mined lead.

★The allocation of a greater propor-

tion of its labor force to development work, and a considerable increase in the number of square-set stopes against open stopes, were factors contributing to a reduction in tonnage at Broken Hill South, Ltd. during the fiscal year. The company spent 50% more on development work than in the preceding year. Working costs reached a new high of £5/14/8 per ton of crude ore, £1/15/2 more than in the preceding year. The lead bonus alone accounted for £1/13/10 per ton of ore mined. For the year, employees' overall earnings averaged £941 (about $3,050), more than three times the official "basic wage."

Encouraged by higher metal values, Broken Hill South has decided to exploit the sulphide ore in the old Mineral Leases 11, 12 and 13 which were acquired in 1943. This will necessitate installation of a winding engine and head gear in the shaft and the construction of a main transport level for the haulage of ore to No. 7 Shaft.

QUEENSLAND

★Increased production and higher metal prices more than offset the rise in costs, to give Mount Isa Mines, Ltd. a profit of £872,921 for the year ended June 30. The preceding year's profit was £502,585. A total of 7,580 ft. of diamond drilling with EX size bits from underground stations disclosed an extensive continuation of excellent grade ore in both lead-zinc and copper orebodies, outside the areas included in the current ore reserve. This comprises 9,608,396 tons of silver-lead-zinc ore averaging 6.4 oz. silver, 8.7% lead and 7.3% zinc.

★Mount Morgan, Ltd. is removing about one million tons of overburden to obtain access to richer ore. The company recently bought two 1½-cu. yd. shovels from American liquidation assets in the Philippines. There are about 2 million tons of pyrites in the Mount Morgan dumps and tailings, assaying about 50% sulphur. Much of this will be utilized in the production of sulphuric acid and fertilizers. These industries have been depending on elemental sulphur imported from the U. S. at annual expenditure of $4 million.

INDIA

★According to information received by the Export Promotion Department of the Board of Trade, London, a well-known firm in India is interested in working phosphate deposits in Madras Province.

Considerable deposits of phosphate occur near Trichinopoly. The Governments of India and of Madras have both long been eager that these should be used for the manufacture of fertilizers. The deposits are, however, not suitable for the manufacture of

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● The suction disc swivels on the hooded bearing frame fit. This means that you can put the suction nozzle in almost any position, including the vertically upward position. This location is particularly convenient if you intend to put the pump directly under a suction tank or chest.

● The shell of the Morris Type "R" Slurry Pump is also simply constructed with extra heavy wall thickness. Its symmetrical shape permits either right or left hand rotation. By swiveling on the suction disc, you can get eight different positions of the suction nozzle.

Other features of the Morris Type "R" Slurry Pump

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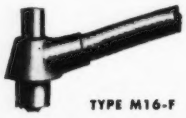
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TYPE M10-F

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India *(Continued)*

superphosphate, partly because the content in P_2O_5 is very low (only about 20%) and partly because the phosphate does not occur in seams but in the form of nodules embedded in clay. It is now proposed to use them for the manufacture of "fused phosphate" fertilizer by the process developed in the U.S.A. and based on the fusing of the mineral phosphate with magnesia and silica in an electric furnace.

One of the promoters of this project has come to America with samples of the phosphate, magnesia and silica, available in abundance near Trichinopoly, but the purchase of the furnaces and auxiliary equipment in the United Kingdom will also be considered, provided it can be supplied within a reasonable time.

AFRICA

Free State mines retarded by lack of power—Rhodesian company to construct refinery in copper belt

★Encouraging development results in the southwestern portion of Sub-Nigel's property have induced its directors to reopen and re-equip E shaft. Some time ago, Nigel Gold Mining Co., Ltd., undertook a drive into this area and advanced 575 ft. in Sub-Nigel's area. Of the 565 ft. sampled all was found payable, averaging 13.6 dwt. over an estimated stoping width of 31 in. (422in.-dwt.). The reopening of E shaft is considered to be the most economical way of exploiting the area.

★A. Chester Beatty, chairman of the Rhodesian Selection Trust and its subsidiary, Mufulira Copper Mines, announced plans for the construction of a refinery to be erected in the copper belt of Northern Rhodesia. The project is to cost £1,500,000 and have an initial annual capacity of 36,000 tons of electrolytic copper. The refinery is expected to begin operations in 1952.

★Tsumeb Corp., Ltd., of Tsumeb, South-West Africa, practically completed its major construction program during the fiscal year ended June 30, and reported a net profit of £386,619.

★Small-scale tests of a new method of reducing the iron content of chrome ore are reported to have yielded promising results.

Details of the process have not yet been made public, but it is stated to be relatively inexpensive and brings low-grade Transvaal ore up to the preferred chemical standard of 48% Cr_2O_3.

Medium to better grades can be made to comply with the minimum chrome-iron ratio of 2.8 to one, it is stated, at a cost of 15s. a ton. In the course of tests, three-to-one metal-to-

metal ratio, with a chromic oxide content of 58.12%, was obtained from Transvaal ore, and it is suggested that this can be improved upon in large-scale operations which are now contemplated. If they prove satisfactory, the Transvaal chrome industry should benefit considerably.

★Base mineral production in South Africa in the first half of this year was higher generally than in the corresponding period last year.

Antimony, asbestos, chrome, coal, copper, iron ore and manganese showed increases, but vermiculite and platinum dropped.

The production figures follow, with the figures for the first six months of 1947 in brackets: (Tonnages are for the short ton of 2,000 lbs.) Antimony 3,660 tons (3,094 tons), amosite asbestos 14,691 tons (7,451 tons), chrysolite 2,141 tons (1,098 tons), chrome 225,300 tons (178,804 tons), coal 13,-161,253 tons (12,744,699 tons), copper ingots 6,742 tons (5,139 tons), blister copper 10,905 tons (9,383 tons), manganese 142,185 tons (139,342 tons), iron ore 654,512 tons (636,082 tons), iron pyrites 20,236 tons (16,975 tons).

The decreases were: vermiculite 8,124 tons (8,177 tons), platinum and the platinum group 34,515 oz. (39,239 oz.) and Cape Blue asbestos 3,806 tons (3,815 tons).

★Progress in the development of some of the Free State mines has been retarded by lack of electric power and shortages of steel and cement, according to reports for the quarter ended Sept. 30.

Highlights from the reports were:

St. Helena: No. 3 (30° incline) shaft was sunk 180 ft. to a final depth of 2,928 ft., and 359 ft. of station work was done. A routine borehole put down from the shaft 2,740 ft. from the shaft collar intersected the Leader Reef which, due to faulting, was duplicated in the borehole. The first intersection of the reef assayed 3.9 dwt. over 65 in. and the value in the second intersection was 1.7 dwt. over 70 in. Another borehole 2.913 ft. from the shaft collar also intersected the Leader Reef, the value being 5.3 dwt. over 33 in. The Basal Reef was not present in either borehole.

Development from this shaft started in September and 147 ft.—all off reef—was accomplished. Crosscuts have been established on the second and fourth levels and it is intended to advance the two south drives as rapidly as possible towards No. 4 shaft. No. 4 shaft (vertical) was sunk 414 ft. to 1,021 ft., and 20 ft. of station work was done.

Free State Geduld: Installation of the collar has been almost completed at No. 2 shaft to a depth of 40 ft. The shaft is being equipped with single-drum winches to obtain a modest advance in sinking until substantial sinking equipment is available. All work was being held up at this shaft due to lack of electric power.

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Dept. K — **Scranton, Pa., U. S. A.**

Africa (*Continued*)

Western Holdings: With the temporary single drum winches No. 1 shaft was sunk another 153 ft. to a depth of 213 ft. The installation of the temporary sinking hoists and the erection of the temporary wooden headgear were nearing completion, but these could not be put into commission until the Electricity Supply Commission provided power to the sub-station at No. 2 Free State Geduld Mines. At No. 2 shaft, Western Ho'dings, excavation for the collar to a depth of 40 ft. had been completed and the pouring of concrete started. There had been considerable delay in the installation of this collar due to poor ground.

After publication of these reports, it was stated that the Free State mines were now receiving the necessary electrical material and plant and that power was being supplied to No. 2 shaft Free State Geduld Mines and No. 1 shaft Western Holdings.

Welkom: Installation of temporary sinking equipment was completed and No. 1 shaft was sunk 140 ft. to a depth of 183 ft. Work was being delayed by the late delivery of equipment.

No. 2 shaft was sunk 404 ft. to 891 ft. At 849 ft. the shaft passed out of the Karroo series into Ventersdorp lavas. Due to the broken nature of the rock the shaft has still to be completely concreted. Work was being hampered by the non-delivery of compressor plant from overseas.

Freddies South: No. 1 shaft was advanced 263 ft. and reached a depth of 524 ft. No. 2 shaft was advanced 87 ft. and reached a depth of 136 ft.

Freddies North: No sinking operations were carried out at No. 1 shaft as the erection of the permanent headgear was still in progress. No. 2 shaft was advanced 227 ft. and reached a depth of 511 ft.

★Continued shaft-sinking at new mines was reported from the Witwatersrand.

Doornfontein: The Annan shaft was sunk 316 ft. to 670 ft. The foundation for the second stage platform hoist was completed and progress made erecting the hoist. No. 1 shaft was sunk 64 ft. to 179 ft.

West Driefontein: Sinking continued in No. 1 shaft through unstable ground which required consolidation by cementation. The shaft was sunk 60 ft. to a total of 1,556 ft. No. 2 shaft was sunk 356 ft. to 2,499 ft. At Nos. 3 and 4 shafts excavations for the shaft collars each reached 61 ft. below collar level. Installation of the collars is progressing.

Blyvooruitzicht: The circular ventilation shaft was sunk 35 ft. to a depth of 3,984 ft. The cross-cut north from the workings on No. 1 level has connected with this shaft. The mine also reported 100% payability in its development. On the Carbon leader 4,540 ft. were sampled, all of it being

payable, assaying 49.8 dwt. over a channel width of 11 in.

During the year ended June 30, total development was 31,943 ft. Reef development totaled 17,408 ft., of which 13,850 ft. were sampled and proved payable with an average value of 60.3 dwt. over a channel width of 11 in. (663 in. dwt.).

Vogelstruisbult: In No. 3 shaft the footage advanced was 578 ft. to a total of 6,065 ft.

Van Dyk: No. 5 sub-vertical shaft was sunk 279 ft. to a depth of 1,415 ft. from 22 level and another 256 ft. of station cutting was done.

★The high-grade lead ore reserves, at Rhodesia Broken Hill, are very extensive, but at present production was limited by the size of the plant, which had a capacity of 1,400 to 1,500 tons a month. At the moment about 1,200 tons a month were being produced, the majority going to South Africa, which was short of the metal.

According to figures, Broken Hill production for the first eight months of this year as compared with the corresponding period last year was: zinc, 14,705 tons (13,985 tons); vanadium, 209 tons (130); lead, 8,590 tons (10,435).

Northern Rhodesia's copper production for the same period was 147,403 tons, valued at £16,712,022, against 122,064 tons valued at £13,803,914.

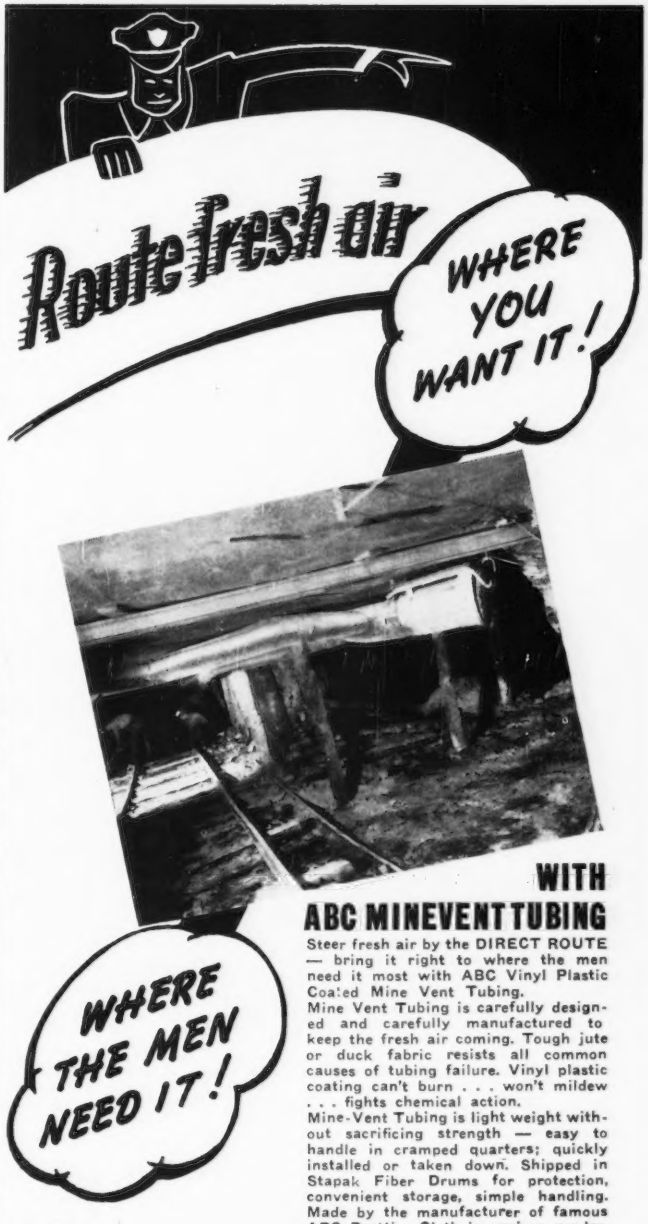
★The Dept. of Mines is investigating tin deposits in the Waterberg and Potgietersrust district of the Transvaal. The work is being done by its mineral development and geological survey sections .

ITALY

Ministry plan calls for $50 million to aluminum industry—Zinc production facilities increased

★The output capacity of the Italian zinc ore mines, and the economic advisability of exporting metallic zinc rather than the ore, have led to the study of means for enlarging the existing foundries and of opening a new electrolytic foundry. A new plant for removing sulphur from the blende is now being added to the foundry at Vago Ligure, which will raise the output potential from the present 8,000 to 12,000 (metric) tons of metal per annum.

At the Marghera foundry (electrolytic) alterations are being made in the roasting furnaces, and the lixiviation works, and those for electrolysis are being enlarged, raising their potential from 8,000 to 12,000 tons of metal per annum. The potential of the foundries at Crotone will be raised from 13,000 to 18,000 tons per annum, while that of Monteponi in Sardinia has already been raised to 6,000 tons.



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Italy *(Continued)*

The opening of the new electrolytic foundry will allow a further increase of output potential of 9,000 tons of metal per annum, obtained by processing some 18,000 tons of zinc ore.

★In the case of lead, the output capacity of the Italian foundries is in excess of the demand on the home market, and of the present and expected supplies of Italian lead ore. Therefore, no enlargement of the existing foundries is planned. However, the long-term plans of the ERP provide for importing lead ore so as to utilize the full output capacity of the foundries.

★Fifty million dollars will be invested in the Italian aluminum industry under the enlargement and development plan for the next four years drawn up by the Ministry of Industry and Commerce. Provision is thus made for meeting the increased demand on the home market in the next few years and for solving the problem of costs, which can be considerably reduced by bringing the plants up to date and centralizing production.

The output of primary and secondary aluminum is expected to stand at 45,000 to 50,000 tons in 1948, judging by monthly averages for the first eight months of the year. As the home market only requires some 30,000 tons, the margin for export will amount to some 15,000 to 20,000 tons, being equal to the average Italian exports of this metal. Should there be no increase in production in the next few years, the increased demand for aluminum by the transport, chemical, electric and building trades would absorb the margin now available for export.

The program is aimed at an annual output of 45,000 tons of primary aluminum and 15,000 of secondary.

★North of the Tirso basin in Sardinia in an area bounded by Ncoro, Macomer and Drani, engineers of the Societa Mineraria Lombarda of Milan have reportedly discovered important uranium and tungsten deposits. A company has been formed for exploitation, and a mining camp will be built in the Marghino hills near Rasu mountain. The company has already engaged miners in Northern Italy for transfer to Sardinia.

CZECHOSLOVAKIA

Labor shortage is greatest problem of mines—Hungary, U.S.S.R. and France to supply aluminum

★The general manager of the Czechoslovak Mining Industry, Engineer Svatopluk Rada, recently outlined the main tasks of this industry in Czechoslovakia during the next five years:

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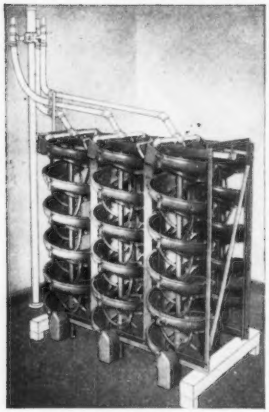

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Czechoslovakia *(Continued)*

"An important job is the increasing of black coal output, as its consumption will steadily rise with the increased demand for coke for foundries of the engineering and metalworking industries. Coal quality will improve with reconstruction of cleaning and sorting installations and buildings for manufacture of briquettes. Another job will be an extensive examination of deposits of minerals, including prospecting in the naphtha areas. By suitable social conditions for miners and other employees of the mining industry, we hope to secure the maximum number of permanent workers, for labor shortage is the most pressing problem in our mines today."

★The labor shortage is affecting the output of the Pribram Ore Mines, National Corp. This concern incorporates all non-ferrous mining in the Czech lands (not Slovakia) and they state that the 1,700-odd miners in their employ are not sufficient for their purposes. The original mining works at Brezove Hory and Bohutin, with their silver-bearing ores, zinc, antimony and copper, and relatively rare cobalt ores were once very rich but suffered by the fall of the silver standard in the last century. Poor working conditions are now a drawback to restoration (the "Anna" mine at Brezove Hory is the deepest mine in Europe). The richest veins are now found at a depth of 1,000-1,400 meters, and the richest ore at Pribram itself in the lead-bearing galena which contains about 2 kilos of silver and 130 kg. lead per ton.

★A new High School of Mines has been set up in Slovakia, at Banska Bystrica. The first two-year courses were recently inaugurated with the beginning of the new school year.

★Under a recently-signed trade agreement for the year 1949, Czechoslovakia is to receive aluminum from Hungary. Plans are being drawn up for a long-term agreement beginning in 1950, and the Czechs are considering the feasibility of feeding electric power to Hungary, in exchange for increased supplies of aluminum. Provision for importing this metal has been made in two other recent agreements, with the U.S.S.R. and France.

Other badly-needed ores will be supplied to Czechoslovakia's expanding metalworking industry by Poland—high-quality coal, zinc and dolomite; and the U.S.S.R.—iron ore, manganese and chromium ore.

★Local output of iron ore for the first nine months of 1948 amounted to 1,059,583 tons; this is more or less according to schedule, but still only about 90% of prewar output. The largest supplier of high-quality iron ore to Czechoslovakia is Sweden; the ore is shipped to Stettin, where the Poles have given free port facilities to the Czechs, and thence by barge down the Oder.

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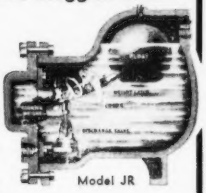

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Mechanized Drifting Speeds

(Continued from page 67)

XCNE, the ground was the same as that encountered in the two-heading operation. Here, too, all advance was untimbered. The same equipment was used. Two contract miners per shift were employed. As to the working cycle, two men barred loose down, wet down, and did the track work. One of two ran the mucking machine and the other the inside motor, servicing cars from the double track about 175-ft. behind the drift face. The two men drilled, blew the holes, loaded them, and blasted. The outside motor trammed loaded cars from the double track to the shaft station. Pipe work and rehanging of the fan bag followed the procedure used in the two-heading operation.

In conclusion, I wish to express my thanks to E. S. McGlone, vice president and general manager, for permission to publish this description. To John Eathorne, foreman of the Badger State mine, and to the staff of the Research Department grateful acknowledgment is made for the help given in gathering the information presented.

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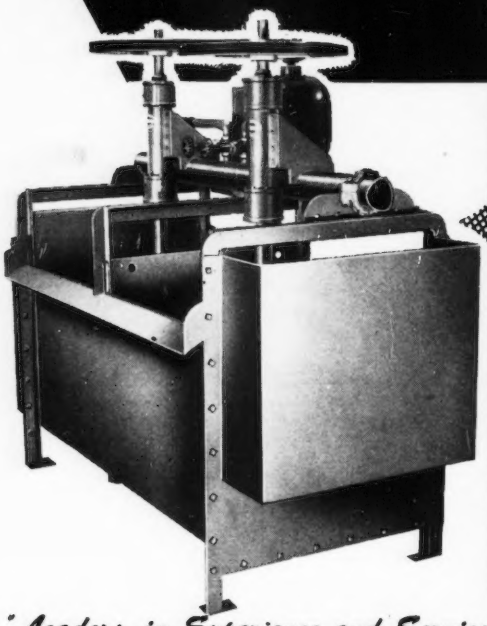

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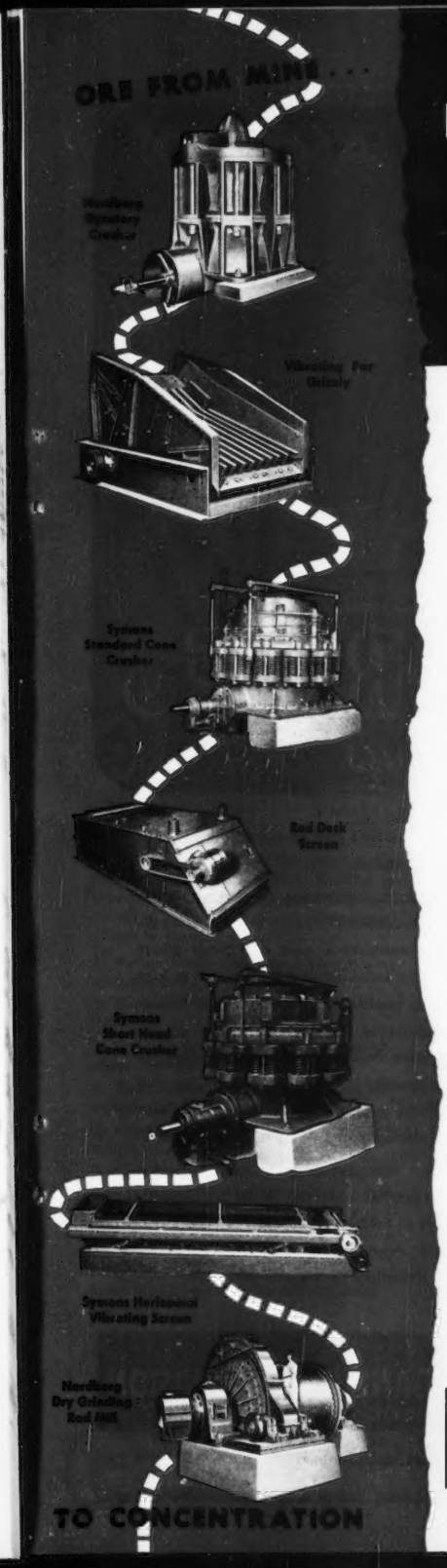

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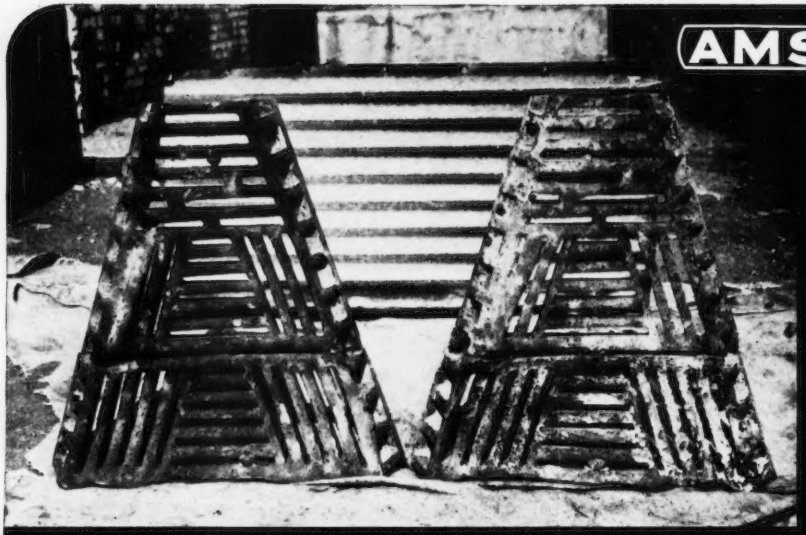

Unretouched illustration of Amsco special manganese steel grates . . . after handling 193,797 tons of gold bearing quartz rock in ball mill.

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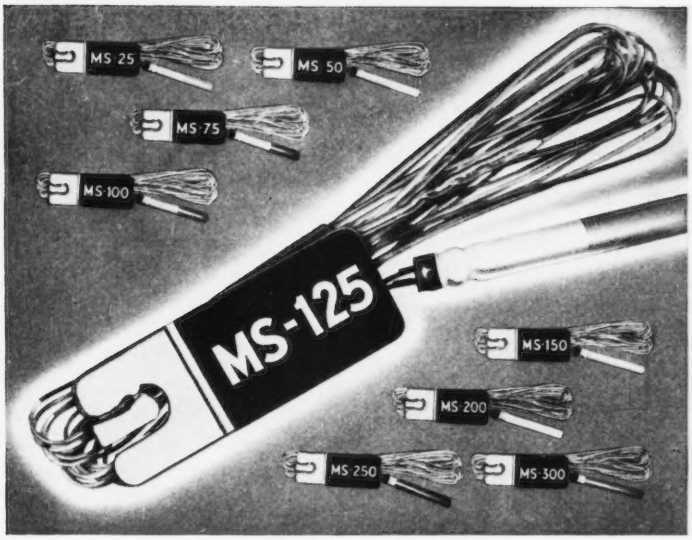

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Underground Ore Miners Approve These Du Pont Products

DU PONT SPECIAL GELATIN

A water-resistant dynamite of high velocity. Plastic and cohesive. Excellent fumes.

DU PONT "GELEX"*

An economical, semi-gelatinous dynamite sufficiently water-resistant to meet most requirements.

DU PONT "EXTRA" DYNAMITES

Efficient and economical for shooting soft ores in many cases.

OTHER DEPENDABLE BLASTING PRODUCTS

DU PONT SUPERIOR CRIMPER
. . . makes a watertight crimp

DU PONT QUICK-SEAL TAMPING PLUGS
simplify tamping

DU PONT BLASTING GALVANOMETER

DU PONT RHEOSTATS

CONNECTING WIRE

LEADING WIRE

Listen to "Cavalcade of America"—Monday evenings—NBC

*Trade-mark Reg. U. S. Pat. Off.

DU PONT

BETTER THINGS FOR BETTER LIVING
. . . THROUGH CHEMISTRY

Check your hauling - -

How many trucks - - how many trips do you require to haul 30-40-60 tons?

300 hp. Walter Tractor Truck, with 40 ton side dump ore trailer

- - and compare with this

One WALTER TRACTOR TRUCK does it, in One fast trip!

Are you using a "fleet" to do the work of one or two Walter Trucks? A switch to Walter high-tonnage hauling will step up your production, at much lower cost per ton. Here's what other mines have found:

Walter Tractor Trucks haul huge loads at good speeds—carry higher tonnage per trip, make more trips per day. You have fewer trucks to operate and service. The great power and 100% four wheel traction hauls unfailingly on soft or slippery surfaces and grades, keeping shovels and plant working at capacity in all kinds of weather.

The smooth, tractive effort of the Walter 4-Point Positive Drive prevents wheel-spinning—the suspended double reduction drive reduces wheel pounding, to greatly minimize wear on tires and roads. Air brakes, power hydraulic steering, short wheelbase all contribute to easy, safe handling and maneuvering.

Have a representative call to discuss your hauling problem. Or write for detailed literature.

WALTER MOTOR TRUCK COMPANY
1001-19 IRVING AVE., RIDGEWOOD 27, QUEENS, L. I., N. Y.

WALTER
4-POINT POSITIVE DRIVE
TRACTOR TRUCKS

Manhattan engineers set out to design a conveyor belt with all the resilience needed to absorb the shock of heavy lumps. The cross-section you see above illustrates how well they succeeded with HOMOCORD, a construction developed specially and *only* for conveyor belt use.

"Rippling Muscles" Construction, is the most apt description of Homocord Conveyor Belt. Each of Homocord's sinews, or strength members, is embedded in muscles of Flexlastics. You can see how this construction dissipates the force of a heavy blow, the constant pounding of heavy material at loading points.

Homocord Conveyor Belt flexes very easily. It troughs much better and runs true in the idlers. These are all factors for longer belt life. Homocord embodies everything you want for heavy mine hauls . . . a cushioned . . . tough . . . flexible . . . mildew-proof conveyor belt that will cut your costs appreciably.

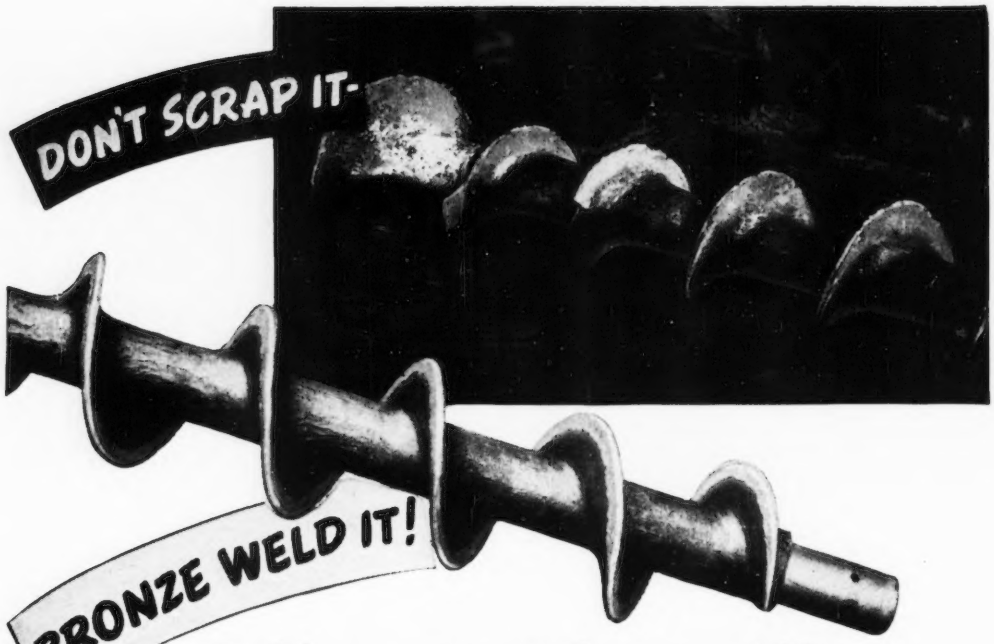
Manhattan also introduced the first long-lift conveyor belt with Rayon Cord Strength Members. Investigate the advantages of RAY-MAN "Tension Master" Conveyor Belt.

Keep Ahead with Manhattan

RAYBESTOS-MANHATTAN INC.

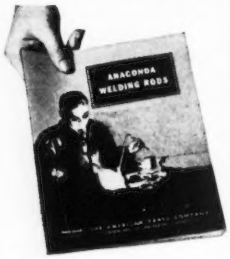
MECHANICAL RUBBER PRODUCTS — RUBBER COVERED EQUIPMENT — FRICTION MATERIAL — ASBESTOS TEXTILES
PACKINGS — POWDERED METAL PRODUCTS — ABRASIVE & DIAMOND WHEELS — BOWLING BALLS

MANHATTAN RUBBER DIVISION **PASSAIC, NEW JERSEY**



Build up worn surfaces *quickly* ... at a fraction of replacement cost

Here's the answer to how, when and why...



The American Brass Company pioneered in the development of Bronze Welding and has a suitable rod for many oxy-acetylene and arc welding purposes. Anaconda Publication B-13 describes these rods and suggests procedures for their use. A copy is yours for the asking.

It's hard to imagine any kind of industrial equipment taking a worse beating than a spiral feed screw. Under tons of wet coal or in a hot ash pit, corrosive and abrasive action are ever-present. To a well known mid-western railroad shop, continual replacement because of worn outer edges proved not only too expensive but unnecessary. Bronze Surfacing was found to be fast—and far more economical.

Welding rods such as "997" Low-Fuming and Tobin Bronze* are extensively used with the oxy-acetylene torch to deposit high strength, dense and tough weld metal on cast iron, malleable iron, steel and copper alloys. By this building-up process many shops are daily saving countless dollars by reclaiming worn parts and industrial equipment:—Sheaves, pulleys, bushings and bearings, pistons, impellers and pump parts, stripped threads and broken gear teeth, thrust plates, hubs, flanges, parts machined undersize, etc.

In addition, low temperature Bronze Welding offers a ready means of repairing broken or fractured production equipment and machine tools. Next time, "Don't Scrap It—Bronze Weld It!"

*Reg. U. S. Pat. Off.

THE AMERICAN BRASS COMPANY

General Offices: Waterbury 88, Connecticut • Subsidiary of Anaconda Copper Mining Company

In Canada: ANACONDA AMERICAN BRASS LTD., *New Toronto, Ont.*

47177

ANACONDA
from mine to consumer

Anaconda Bronze Welding Rods

BROWNHOIST DIESEL ELECTRIC LOCOMOTIVE CRANES...30 • 35-40 • 40-50 TON CAPACITIES

PATENT APPLIED FOR

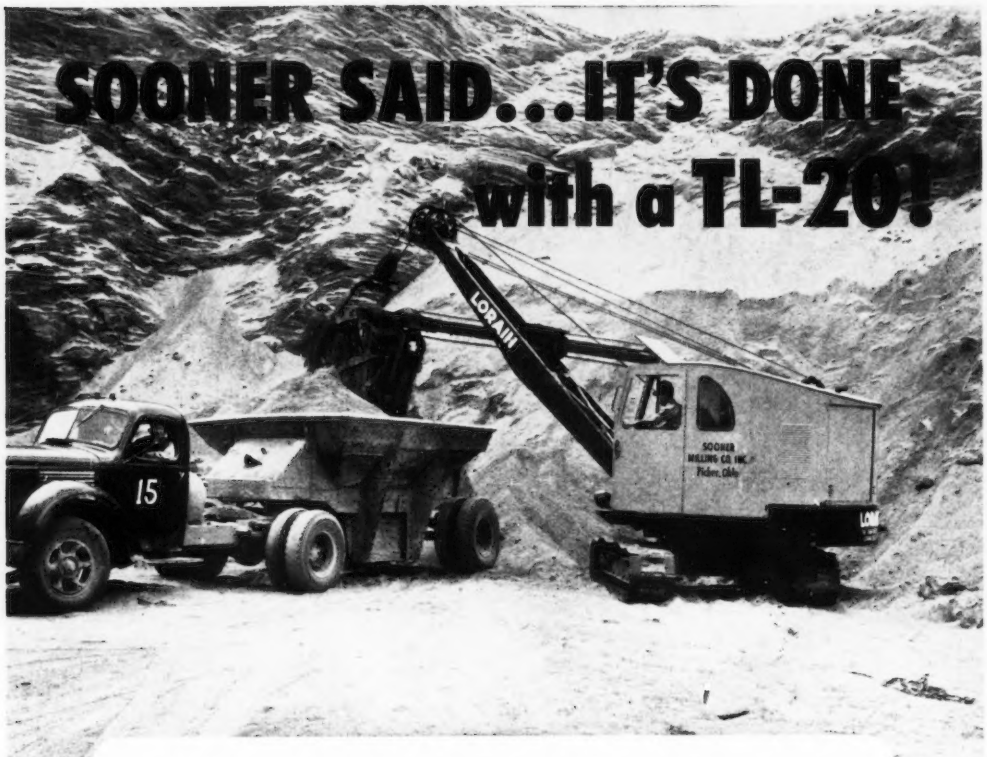
LOOK AT ALL THESE FEATURES!

ROLLER BEARING BOOM-TIP SHEAVES
PATENTED 360° MONITOR TOP CAB
SUMMER AND WINTER FAN GIVES ALL WEATHER COMFORT
HOIST DRUMS ROLLER BEARING MOUNTED
SAFE WORM DRIVEN BOOM HOIST
DIESEL ELECTRIC
DOUBLE DISC SMOOTH OPERATING ROLLER BEARING MOUNTED ROTATING CLUTCHES. ELECTRIC SWING AVAILABLE
14" SAFETY CLEARANCE
CAST STEEL SIDE FRAME TRUCKS
INSIDE HUNG SPRING SUSPENDED ELECTRIC MOTORS ON TRUCKS ELIMINATE TRAVEL CLUTCHES AND GEARING

BROWNHOIST BUILDS BETTER CRANES

INDUSTRIAL BROWNHOIST CORPORATION • BAY CITY, MICHIGAN

DISTRICT OFFICES NEW YORK, PHILADELPHIA, CLEVELAND, CHICAGO • AGENCIES: DETROIT, BIRMINGHAM, HOUSTON, DENVER, LOS ANGELES, SAN FRANCISCO, SEATTLE, VANCOUVER, B. C., WINNIPEG, CANADIAN BROWNHOIST LTD., MONTREAL, QUEBEC.



LORAIN TL-20 WORKS 24 HRS. PER DAY LOADING 2000 YDS. OF MINE TAILINGS FOR SOONER MILLING CO., PICHER, OKLA.

There's no rest for this rugged Lorain TL-20 for it works 'round the clock without rest or letup! Owned by the Sooner Milling Co., Picher, Oklahoma, and operated near Cardin, Okla., the tireless TL-20 is on the job 24 hours a day loading mine tailings for retreatment to recover zinc and lead concentrates. The unit averages 2000 yds. per day or between 60,000 and 70,000 tons per month . . . *another* example of Lorain machines' inherent stamina.

It's a matter of record that no other machine offers so much for its size with "on-the-job" case histories to prove the value of each and every outstanding feature.

Your Thew-Lorain distributor will gladly put you in touch with nearby TL-20 owners for first-hand information and conclusive proof of the consistently higher production obtainable with these better built machines. Why not contact him, today?

THEW-LORAIN 1899 50 1949 ANNIVERSARY

THE THEW SHOVEL COMPANY • LORAIN, OHIO

Lorain Thew TL 20 Lorain

Performance-Proven

POWER PLANTS

International Diesels are *performance-proven.* They have given remarkably dependable and economical service as the engines in International Diesel Crawler tractors. There just isn't any rougher work for an engine. Heavy loads, tough working conditions and long hours of operation all combine to give a crawler tractor engine a real going over.

Make no mistake about it. International Diesels are *performance proven.* You can be sure that you get full measure of profit-producing power from any International Diesel you select.

See your International Industrial Power Distributor or Dealer about your power requirements. He handles the full line of International Diesel and gasoline power units listed at the right.

He will be glad to help you select the right International Power Unit for your specific requirements. And you'll get the benefit of profit-producing power.

INTERNATIONAL ENGINES are available as complete power units in the following models:

DIESEL:	UD-24	180 h.p. @	1375 r.p.m.
	UD-18A	125 h.p. @	1600 r.p.m.
	UD-16	100 h.p. @	1800 r.p.m.
	UD-14A	76 h.p. @	1400 r.p.m.
	UD-9	53 h.p. @	1500 r.p.m.
	UD-6	39 h.p. @	1500 r.p.m.
GASOLINE:	U-9	55 h.p. @	1500 r.p.m.
	U-6	41 h.p. @	1500 r.p.m.
	U-4	31½ h.p. @	1800 r.p.m.
	U-2	22 h.p. @	1800 r.p.m.

Write for informative catalogs on International Power Units:

Form **A-54-LL**
INTERNATIONAL ENGINES AND POWER UNITS
Gas, Gasoline or Distillate

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INTERNATIONAL DIESEL ENGINES AND POWER UNITS

INTERNATIONAL HARVESTER COMPANY
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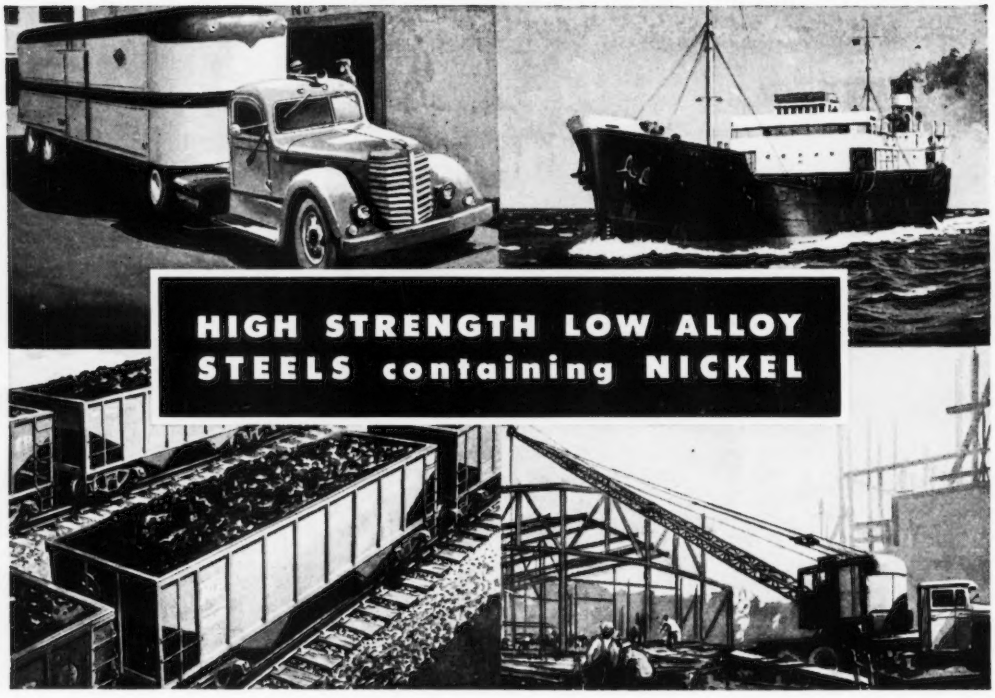
Listen to James Melton on "Harvest of Stars" every Wednesday evening—CBS

Standardize on Power that Pays

INTERNATIONAL
INDUSTRIAL POWER

CRAWLER TRACTORS
WHEEL TRACTORS
DIESEL ENGINES
POWER UNITS



Reduce Weight...
Increase Durability

Excellent mechanical properties characterize high strength low alloy steels containing nickel...

Steels of this type provide high strength in the as-rolled condition, and sheet gauges may be cold formed into structural panels that assure maximum weight reduction without sacrifice of strength or safety.

They provide good toughness and ductility at both room and subzero temperatures. Moreover, by resisting abrasion, erosion and many types of corrosion, these steels help substantially to lengthen equipment life.

Although primarily developed for use in mobile equipment . . . for weight saving and corrosion resistance . . . low alloy high tensile steels are now finding application in many diversified fields where durability is essential to reduce both maintenance and operating costs.

Moderate in cost, and produced under various trade names by leading steel companies, high strength steels containing nickel along with other alloying elements pay for themselves.

A list of sources of supply will be furnished on request.

EMBLEM OF INCO SERVICE

Over the years, International Nickel has accumulated a fund of useful information on the properties, treatment, fabrication and performance of engineering alloy steels, stainless steels, cast irons, brasses, bronzes, nickel silver, cupro-nickel and other alloys containing nickel. This information is yours for the asking. Write for "List A" of available publications.

THE INTERNATIONAL NICKEL COMPANY, INC. 67 WALL STREET NEW YORK 5, N. Y.

Truco bits are used throughout the world *because*

★ they hold gauge longer

★ they cut faster

★ they are exceptionally tough and absorb punishment

★ they give greater salvage

★ they are availble in SOFT, MEDIUM or HARD matrix to provide highest efficiency in any formation

★ they are backed by a speedy reset-ting service.

Write for information and prices.

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WHEEL TRUEING TOOL CO. of CANADA, LTD.
575 Langlois Avenue
Windsor, Ont. • Canada

CHEMICO *has the experience in the design and construction of*
SYNTHETIC AMMONIA PLANTS

"There is no substitute for experience." That's particularly true when it comes to designing and constructing plants for the production of synthetic ammonia. For more than twenty years Chemico, utilizing the well known N. E. C. Process, has been the leading builder of this type of installation.

Today, Chemico helps in the fight to feed the world by designing and supervising the construction of complete plants for the production of nitrogenous fertilizer.

IN INDIA . . . 350,000 tons a year of ammonium sulfate will be produced by a plant at Sindri to be operated by the Indian government.

IN EGYPT . . . every day 550 tons of calcium nitrate will flow from the great plant at Suez . . . to be built for the Societe Egyptienne d'Engrais et d'Industrie Chimiques (S. A. E.).

IN MEXICO . . . 70,000 tons of low-cost ammonium sulfate will flow from a new plant near Mexico City to be built for Guanos y Fertilizantes S. A., Mexico's leading fertilizer manufacturer.

In other strategic places throughout the world—as well as in the United States—Chemico is helping to meet the need not only for fertilizer, but also for sulfuric acid, synthetic ammonia, synthetic methanol and other heavy chemicals.

In each of these projects the Chemico organization functions as Architect-Engineers in charge of design, procurement of equipment, supervision of construction, training of personnel and initial operation.

Chemico's extensive experience in these and hundreds of other installations is your guarantee of performance . . . your assurance of economical and efficient operation.

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CHEMICO CHEMICAL CONSTRUCTION CORP.

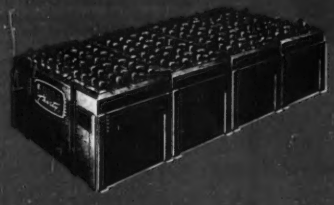
CHEMICO PLANTS ARE PROFITABLE INVESTMENTS

Only GOULD Has It!

Gould uses the Metalloscope to photograph high magnifications of the structure of lead connectors, posts and grid frames.

A modern research laboratory with pilot manufacturing plant where advance-design batteries are constantly created—and proved before production.

The Metalloscope, a combination high-powered microscope and camera, is helping Gould scientists find the answers to age-old lead casting problems. With it, the complex crystalline structure of lead castings has become an open book. As a result, information rapidly becoming available points the way to even stronger, electrically more efficient grid frames, posts, straps and connectors. For better batteries always, choose GOULD—FOR FIFTY YEARS THE CHOICE OF ENGINEERS.



The Gould "Thirty"—America's Finest Motive Power Battery!

GOULD

STORAGE BATTERY CORPORATION

Including the Storage Battery Division of Philco Corporation

TRENTON 7, NEW JERSEY

Always Use Gould Automobile and Truck Batteries

ready for bigger bites, bigger loads...
and good for twice the service!

STOODY SELF-HARDENING 21

puts extra life in worn equipment—easier, faster, with greater economy

There are multiple advantages for operators who hardface bucket lips and fronts with the new, Bare STOODY SELF-HARDENING 21. Size is restored quickly because of a new, record burn-off speed. You get heavy buildups in *one pass* and there's no slag to chip on multiple passes. With D.C. welders, Bare Stoody Self-Hardening 21 runs as easily as coated—can even be applied with A.C. equipment!

If you want greater payloads, renewed efficiency and double the service life from your buckets, try 50 lbs. of Stoody Self-Hardening 21 today. You'll appreciate its smooth-running qualities and exceptional abrasion resistance. ¼" and ⅜" rod diameters cost only 60c per lb.—less in quantity.

Call your nearest Stoody dealer for information and literature.

STOODY COMPANY 1140 W. SLAUSON AVE., WHITTIER, CALIF.

Announcing ... ANOTHER BECKMAN ADVANCEMENT IN SPECTROPHOTOMETRY

THE BECKMAN MODEL "B" SPECTROPHOTOMETER

Accurate—Convenient—Versatile ... and Low Priced

Note simplicity of controls. Also note the sloping panel that permits easy readability of scales from both sitting and standing positions.

ADVANCED FEATURES DESIGNED INTO THE MODEL "B" INCLUDE ...

CONVENIENCE:

Direct reading wavelength scale ... 320 to 1000 millimicrons ... readings reproducible to great accuracy.

Direct reading transmission and absorbance (optical density) scales on large easily-read meter.

Continuously variable slits for smooth, precise settings.

4-Position sensitivity multiplier permits readings to be made on most advantageous portion of scale.

Four position cell carriage permits quick positioning of any of 4 cells by an external control.

ACCURACY:

Photometric accuracy to 0.5% transmission or 1% absorbance.

Negligible stray light—stray light effects completely eliminated between 360 and 1000 millimicrons ... less than 1½% even at 320 millimicrons.

Resolution—permits less than 5 millimicron band width over most of spectral range.

VERSATILITY:

Liquid, solid and gaseous samples may be analyzed.

Monochromatic light beam is easily brought outside the instrument for long path measurements and special uses.

Accommodates large cells up to 50 m. m. path length in standard cell carrier.

Interchangeable photocells—red or blue-sensitive to utilize the high resolving power of the Model "B".

Easily-attached Model "B" accessories will be available for special types of measurements and for added convenience and accuracy. Write for details.

The new Model "B" Spectrophotometer is by far the outstanding routine instrument available. It provides advancements pioneered in the Beckman Quartz and Infrared Spectrophotometers but never before offered in a low priced instrument. These advantages are important because they combine simplicity, convenience and versatility without sacrificing accuracy and reliability.

The Model "B" has better ultraviolet performance ... better resolution ... better wavelength and photometric accuracy ... and more freedom from stray light than any other instrument in its field.

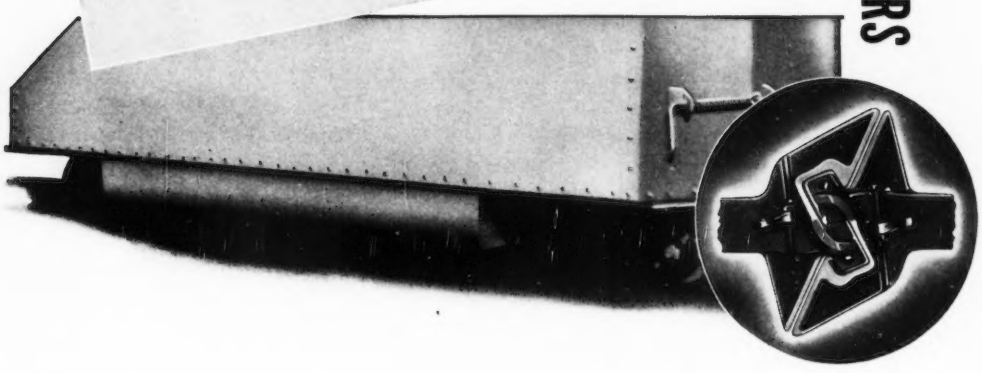
A descriptive bulletin on the Beckman Model "B" Spectrophotometer will gladly be sent on request. Write today. *Beckman Instruments, National Technical Laboratories, South Pasadena 27, California.*

BECKMAN

INSTRUMENTS CONTROL MODERN INDUSTRIES

pH Meters and Electrodes—Spectrophotometers—Radiation Meters—Special Analytical Instruments

Increase large-car tonnage WITH WILLISON AUTOMATIC COUPLERS



Tonnage increases *per day* as well as *per car* when large cars are equipped with Willison Automatic Couplers.

That's because they handle faster—more safely. Willison Couplers are always ready to couple when brought together. Even though cars are reversed in position, they will couple instantly because Willison contours are alike. All these add up to faster car movements, more tons per day per car, large or small.

These advantages are long-lived, too, because Willison Automatic Couplers are simply and sturdily built. Two essential parts do all the work—the head and the lock. They reduce shocks and strains—your equipment lasts longer, needs less maintenance.

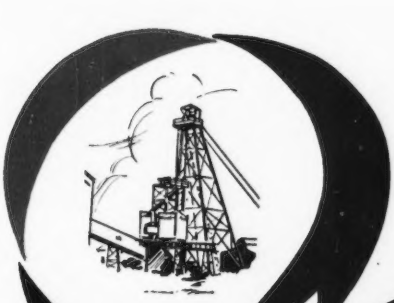
You move tonnage faster, safer, and at lower cost with Willison Automatic Couplers.

NATIONAL Products FOR TRANSPORTATION AND INDUSTRY Est. 1868

NATIONAL MALLEABLE AND STEEL CASTINGS COMPANY

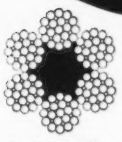
CLEVELAND, OHIO

WILLISON AUTOMATIC COUPLERS • NACO STEEL WHEELS • NACO STEEL LINKS AND SWIVEL HITCHINGS



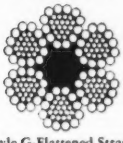
-Preformed-
"HERCULES"
REG. U.S. PAT. OFF.
RED-STRAND
WIRE ROPE

Easy to Handle . . . Safe and Economical to Use

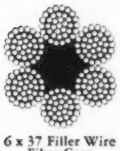


6 x 19 Filler Wire Fiber Core

6 x 19 Seale Wire Rope Core



Style G-Flattened Strand Fiber Core



6 x 37 Filler Wire Fiber Core

6 x 41 Wire Rope Core

"HERCULES" (Red-Strand) Wire Rope has proved its worth by the accurate yardstick of actual performance. For over 60 years the Red-Strand has been a dependable guide to safe and economical wire rope service. Now in the Preformed type, a plus value has been added. As internal stresses are largely eliminated, the rope is less apt to kink . . . it is easier to handle . . . it spools better. But these are not the only advantages. Because internal stresses have been reduced there is less internal wear and more resistance to bending fatigue, which means longer life.

Another and an ever important factor in determining wire rope life is the use of the right construction for the work the rope is to do. To meet this situation, Preformed "HERCULES" (Red-Strand) Wire Rope is made in a wide range of both Round Strand and Flattened Strand constructions. There is a correct type for any heavy duty job. Our Engineering Department will be glad to help you make the right selection.

We invite your inquiries.

"HERCULES"
RED-STRAND
the DEPENDABLE
WIRE ROPE
for any TOUGH JOB
REG. U.S. PAT. OFF.

MADE ONLY BY

A. LESCHEN & SONS ROPE CO.

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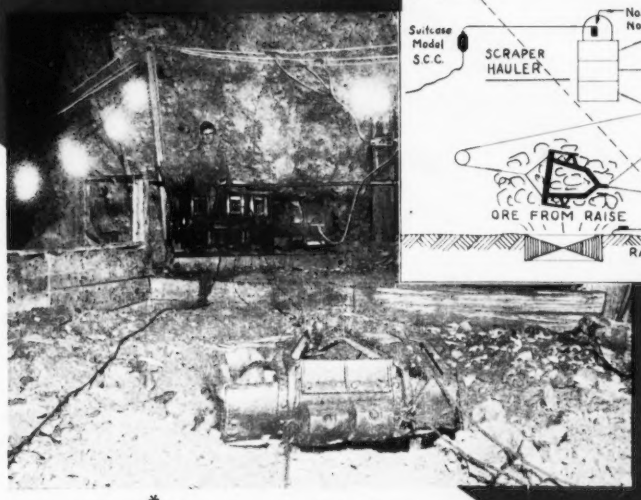
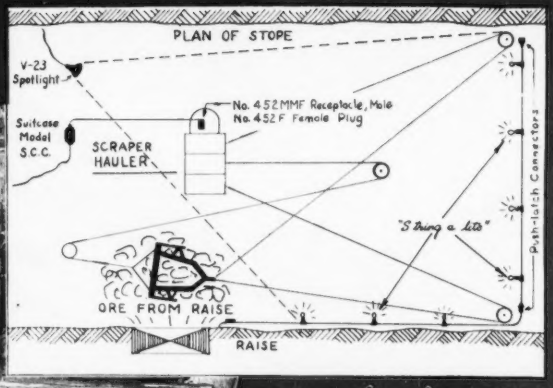
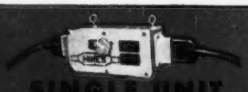
NEW YORK 6 • CHICAGO 7 • HOUSTON 3 • DENVER 2
LOS ANGELES 21 • SAN FRANCISCO 7 • PORTLAND 9 • SEATTLE 4

PARTNERS in Production







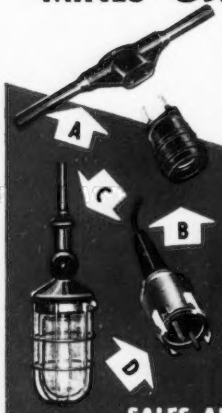
SINGLE UNIT S. C. C. (Safety Circuit Center)

MINES Safety Circuit Centers, available in single and multiple unit models to fit any mining need can be purchased with start resistors or protective transformers covering any or all of the latest electrical protective devices for men and machines.

MINES "*String-a-lite"... Connectors ... Distribution Centers

(*) Registered Trademark

Since '26 MINES has specialized in designing and manufacturing molded "Neoprene" rubber Connectors, portable lighting lines and associated essentials for American mining. Whenever mining machinery moves or must be moved, MINES Safety Circuit Centers, Plugs, Receptacles and String-a-lite lines, simplify sectionalization and increase the safety of portable power lines. Consult your nearest [illegible] Engineer for complete details.



A FSC—FEMALE OUTLET—used on MINES Weather-proof String-a-lite assemblies. Molded of Neoprene with Weather-seal. Accommodates ERS lamp socket (B below). Available spaced on lengths of cable to meet mining requirements.

B ERS—LAMP SOCKET—used on MINES Weather-proof String-a-lite assemblies. Plugs into FSC female outlet (A above). Accommodates 100 watt standard Edision based bulb. Molded of "Neoprene."

C VPL-G—LAMP SOCKET—used in MINES Vapor-proof String-a-lite assemblies. Has metal guard and protective inner glass globe. Socket molded of Neoprene. Available spaced on lengths of cable to meet mining requirements.

D 82A1870 MALE PLUG—used in MINES Vapor-proof and Weather-proof String-a-lite assemblies. Push-Latch type with Weather-seal. Cannot become disconnected accidently. 82A1869—companion Female Connector.

E 452—FEMALE [illegible] PLUG—[illegible] molded to one piece to cable. Has outer hood assembly Neoprene leathers and resistance contacts, moisture and dust seal. 452M Companion Male Connector.

F 452 MMF MALE [illegible] RECEPTACLE—has Neoprene insert with terminal bush. Fits connectors described in E above. Aligns properly for better fit.

G V23 200 WATT VAPOR-PROOF SPOTLIGHT—supplied with metal mounting bracket and 5' of Neoprene insulated cord. Has "Push-Latch" type plate and connector.

SALES AND SERVICE TO THE MINING INDUSTRY EXCLUSIVELY BY

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2,000,000 tons of ore on original bearings

●At this iron mine near Buhl, Minnesota, a PIONEER MESABI SCALPING SCREEN recently completed its fifth season of operation without major repairs. During this period more than 2,000,000 tons of iron ore were screened on the original bearings . . . *and it's still going strong!*

While this is a great tribute to the SKF bearings, it is a far greater tribute to the balance and rugged construction built into all PIONEER MESABI SCREENS. For, as mining men know, an unbalanced screen can ruin the best set of bearings in a short time.

Though neither the largest nor the strongest of the screens that PIONEER has furnished to the mines, this 5′x 8′ MESABI typifies what you can expect when you install screens by PIONEER.

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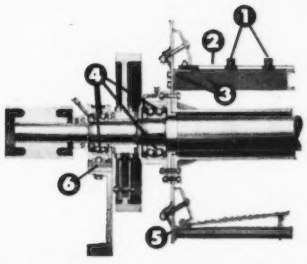

CHECK THESE CONSTRUCTION FEATURES OF PIONEER MESABI SCREENS

1. **LONGITUDINAL STEEL BARS** lengthen life of screen.
2. **SCREENING DECK** built from punched steel plate or heavy wire cloth.
3. **FIRM SCREEN SUPPORT** provided by longitudinal angle iron reinforcing and channel iron cross-bracing.
4. **SKF SPHERICAL, SELF-ALIGNING BEARINGS** — fully enclosed and sealed with all metal grease seals.
5. **BALANCED PAN** gives positive screening action at both ends of screen as well as in the center regardless of load.
6. **HEAVY MAIN FRAME** is cross-braced with angles. Longitudinal bracing includes extra plates under bearings.
7. **SIZES**—4 x 10, 4 x 12, 5 x 8, 5 x 10, 5 x 12, 5 x 14 with single and double decks.

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For a complete explanation of the Exclusive Cummins Fuel System and how it can cut your fuel bills, write Cummins Engine Company, Inc., Columbus, Ind., for Bulletin 5275.

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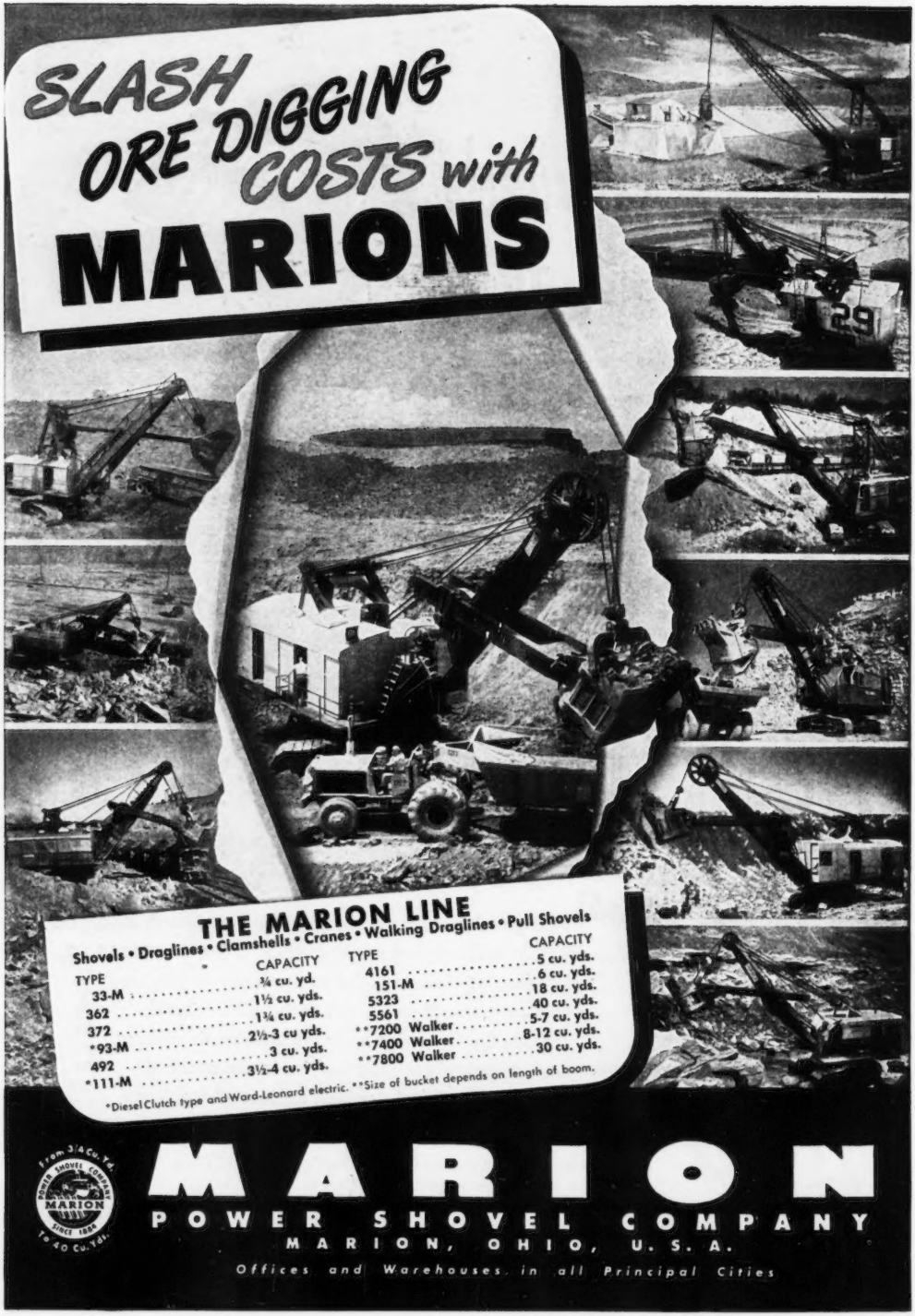
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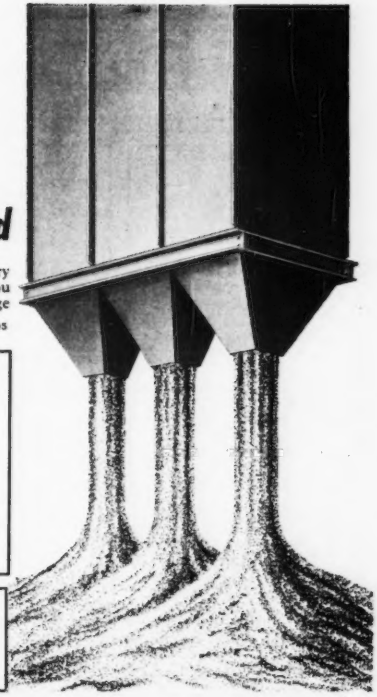

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RC-105

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200 Metallurgical Installations
203 Acid Plants • 34 Paper Mills
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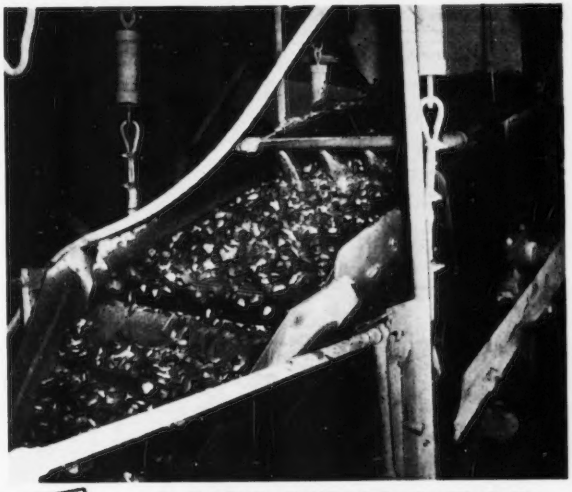

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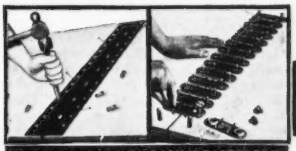

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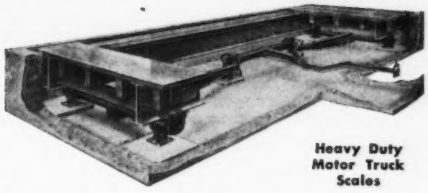

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BOX — 386

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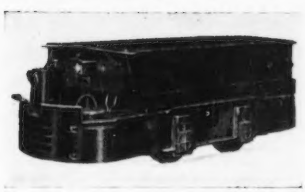
Mining and Concentrating Machinery
LARGE STOCK-FULLY RECONDITIONED



LOCOMOTIVES

2—2 to 2½ ton Mancha Battery, 18" gauge.
1—2 to 2½ ton Whitcomb Battery Locomotive, 24" gauge.
2—5 ton Jeffrey Battery, 42" gauge.
2—7 ton General Electric Permissible Type Battery Locomotive, 36" gauge.
1—7 ton Mancha Battery, 36" gauge.
3—6½ ton General Electric Trolley Locomotives, 36" gauge.
1—5" x 10" Porter Compresser Air Locomotive, 18" gauge.
1—8½" x 10" Baldwin Compressed Air Locomotive, 30" gauge.
1—3 ton Whitcomb Gasoline Driven Locomotive, 24" gauge.
1—3 ton Ruth Gasoline Driven Locomotive, 18" gauge.
1—50 ton Brooks Steam Locomotive with Tender, 36" gauge.
2—18 ton Davenport Steam Locomotives, 1-36" gauge, 1 standard gauge.

ORE CARS

1—12 cu. ft. Rocker Dump, 18" gauge.
3—18 cu. ft. Rocker Dumps, 18" gauge.
6—23 cu. ft. Rocker Dumps, 18" gauge.
2—20 cu. ft. Rocker Dumps, 24" gauge.
3—34 cu. ft. Rocker Dumps, 18" gauge.
3—55 cu. ft. Rocker Dumps, 30" gauge.
12—84 cu. ft. Rocker Dumps, 36" gauge.
6—2 cu. yd. Koppel Rocker Dumps, 36" gauge.
1—14.3 cu. yd. Koppel Rocker Dump, 36".
1—14.3 cu. ft. End Dump, 18" gauge.
3—14 cu. ft. Gable bottom, 18" gauge.
1—4 cu. yd. Austin-Western 2-way Side Dump, 24" gauge.

DIESEL-ELECT. GEN. SETS

3—15 KW, Century Generators, 3/60/127-220, driven by 35 HP. Waukesha-Hesselman 4-cylinder Diesel Engines.
1—30 KW, Century Generator, 3/60/127-220, driven by 36 HP. Buda 6-cylinder Diesel Engine.
1—50 KW, Western Electric Generator, 3/60/220, driven by 85 HP. Cummins, 6-cylinder Diesel Engine.

CLASSIFIERS

1—36" x 20' Dorr Duplex Rake Classifier.
1—54" x 16' Morse "Trueline" Duplex Rake.
1—8' Bowl Attachment for Dorr Classifier.
3—"St. Joe" Type Hydraulic Classifiers, 10 cells, 20 spigots.

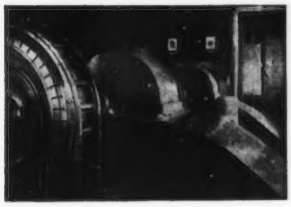
DRILL SHARPENERS

2—Ing.-Rand No. 5 with Punching Attach.
1—4R-40 Ing.-Rand Drill Sharpener.
1—Ing.-Rand No. 50 Drill Sharpener.
1—Sullivan Portable Drill Sharpener, Class E, "Little Smithy."

MOTOR GENERATOR SETS

1—¼ KW MG Set, 220v.
1—1/3 KW MG Set, 125v.
1—9/10 KW MG Set, 220/440v.
1—KW MG Set, 250v.
1—5 KW Crocker-Wheeler MG Set, 250v.
1—7½ KW G.E. MG Set, 220v.
1—7½ KW Wilson MG Set, 220v.
1—12 KW Holtzer-Cabot MG Set, 110v.
1—25 KW ft. Wayne MG Set, 250v.
1—75 KW Ridgway MG Set, 125v.
1—165 KW G.E. MG Set, 600v.
1—250 KW Westinghouse MG Set, 600v.

COMPLETE HYDRO-ELECTRIC POWER PLANT



Total Capacity 900 KW
Consisting of 2—450 KW General Electric Generators with De-Remer-Box Double Water Wheels, Governors, Exciters, Switchboards, Building, Crane, and Pipeline.

PUMPS

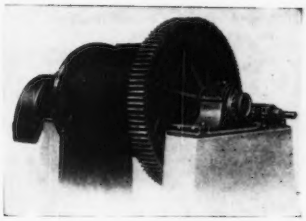
1—2" Wilfley Sand Pump.
1—3" x 3" Allen-Sherman-Hoff Rubber Lined Hydro-seal Pump.
1—5" Tellurium Centrifugal Sand Pump.
1—4" Traylor Centrifugal Sand Pump.
2—6" Wilfley Sand Pumps.
2—4" Butchart Diaphragm Pumps.
1—No. 4 Dorrco Diaphragm, acid proof.
3—4" New Ingersoll-Rand Motor Pumps.
8—1" New Faclic Monobloc Pumps.
1—1½" Ingersoll-Rand Motor Pump.
4—3" Ing.-Rand Motor Pumps, bronze fitted
1—1" Buffalo Centrifugal Pump.
10—1½" New Goulds Centrifugal Pumps mounted on adjustable base with 1½ HP Westinghouse motors.
125—1½" New Deming Centrifugal Pumps with 1½ HP General Electric motors and adjustable bases.
1—2" Worthington Centrifugal Pump.
1—2½" Ingersoll-Rand Centrifugal Pump, 300' head, 300 gallon per minute, mounted on common base and direct connected to 40 HP Gen. Elec. motor.
1—3" Goulds Centrifugal Pump.
1—4" Byron Jackson Centrifugal Pump.
1—6" Goulds Centrifugal Pump.
1—7" Fairbanks Morse Centrifugal Pump.
1—8" Fairbanks Morse Centrifugal Pump.
1—10" Morris Centrifugal Pump.
1—12" Morris Centrifugal Pump.
4—2⅛" 4-stage Pennsylvania Centrifugals.
4—3" 6-stage United Centrifugal Pumps.
1—2½" Krogh Centrifugal Sinking Pump.
17—2" New Jaeger Portable Self-Priming Pumps, direct connected to 2½ HP. Wisconsin air-cooled gasoline engines.
2—2½" x 1½" Economy 4-stage Pumps, direct driven by 50 HP Chrysler Industrial engines.
101—¾" New Blackmer Rotary Hand.
33—1" New Blackmer Rotary Hand Pumps.
1—4" x 5" Deming Horizontal Simplex Piston Pump.
1—4" x 6" Fairbanks-Morse Duplex Piston Pump.
1—2½" x 6" Goulds Vertical Triplex.
1—3½" x 3½" x 5" Fairbanks Morse Duplex Steam Pump.
2—4 x 4 x 2¾" Ingersoll-Rand Vacuum.

JACKBIT GRINDERS

2—JA-4 Ing.-Rand Air Motor Driven.
1—J-3 Ing.-Rand Heavy Duty Bit, direct connected to 3 HP. West. Motor, 1/60/110-220.

G.E. FURNACE TRANSFORMERS

3—80 KVA, 1 ph., 60 cycle, type H, form V, voltage: 440/60/55/51/47/44/39/36/33/30.
3—500 KVA, 1 ph. 60 cycle, type H, form KDH, 12,000/80-40 volts.



BALL AND ROD MILLS

1—3' x 8' Denver Engr. Co. Tube Mill, approx. wt. 12,000 lbs.
1—3' x 9' Ruth Open End Rod Mill, approx. wt. 16,750 lbs.
1—4' x 11' Ruth Open End Rod Mill, approx. wt. 31,000 lbs.
1—4' x 4' New Colorado Iron Works Ball Mill, complete with hard iron liners, approx. wt. 15,000 lbs.
1—5' x 22" Hardinge Conical Ball Mill, approx. wt. 19,000 lbs.
1—6' x 36" Hardinge Conical Ball Mill.
1—6' x 8' Marcy Cast Iron Ball Mill, approx. wt. 60,000 lbs.
1—8' x 22' Hardinge Conical Pebble Mill.

FILTERS

1—3' x 4' Oliver Continuous Drum Filter.
1—6' x 3—Disc American Continuous Disc.
1—6' x 4—Disc American Continuous Disc.
1—18" New Morse Bros. Round Pattern Filter Press.

BLOWERS

16—Type HS New Amer. Vol., 12,000 CFM, direct driven by 7 to 12½ HP Wagner mtrs., 440 v.
21—Type HS New Amer. Vol., 12,000 CFM, direct driven by 12¼ HP G. E. DC mtrs. (6 to 115 v. mtrs., 15 with 230 v. mtrs.)

SHOVEL LOADERS

3—Elmco rocker shovels, model 12B.
4—Goodman "Conway" mucking machines, type 50A.

JAW CRUSHERS

1—8" x 8" Universal semi-steel crusher.
1—8" x 24" Rogers cast steel crusher.
1—9" x 16" Cedar Rapids All Steel Crusher.
1—8" x 36" Universal all steel crusher.
1—15" x 20" Universal All Steel Crusher.
1—24" x 36" Traylor type A Blake crusher.

SYMONS CONE CRUSHER

1—3' Symons Cone Crusher, fine cone.

GYRATORY CRUSHERS

1—26 Kennedy-VanSaun roller bearing.
1—237 Kennedy-VanSaun type S roller bearing fine reduction crusher.
1—10" Traylor "Bulldog" type T crusher.

MISCELLANEOUS EQUIP.

1—Ainlay Centrifugal Gold Separator, type C.
2—New Jeffrey Vibrating Feeders, type 2A.
3—19" x 24" Pierce Type Riffle Amalgamators.
860—ft. 24" x 7 ply Rubber Covered Belting, 9/16" thick.
6000—ft. New 1½" Jones & Laughlin Improved Plow Steel Wire Rope, 6x19, lang lay, hemp center.
1539—ft. New No. 4 Electric Cable, 3 conductor, 600 volt, asbestos-rubber covered, basket weave armor. Mfd. by General Cable Co. and Anaconda.
1—3' x 5' Hardinge Volumetric Belt Feeder.

SEND FOR RECONDITIONED STOCK LIST BULLETIN NO. 481.

REBUILDERS OF MINING AND CONCENTRATING MACHINERY SINCE 1898

BETTER MACHINERY—IT'S FULLY RECONDITIONED

ESTABLISHED 1898

MORSE BROS. MACHINERY CO.

P.O. BOX 1708 DENVER, COLORADO, U.S.A. CABLE "MORSE"

GENERAL OFFICE AND PLANT 2900 BROADWAY, DENVER, COLORADO

COMPLETE ORE-MILLING CONCENTRATION PLANTS · FLOTATION · MACHINERY · CYANIDE · AMALGAMATION

DIESEL GENERATORS
8—D-13000 Caterpillar Diesel Engines, direct connected to 75 KW, 440 volt AC Generators.
1—D-4400 Caterpillar Diesel Power Unit, V-belted to 220 volt AC Generator.

CLASSIFIERS
1—6' x 22' Door Duplex.
1—45" Akins High Weir-Spiral.
1—60" x 23' Denver Simplex Cross-Flow.

PUMPS—HYDROSEAL
1—2" Allen-Sherman-Hoff, Rubber Lined, B.D.
3—6" Allen-Sherman-Hoff, Rubber Lined, with 20 HP Motors.
1—8" Allen-Sherman-Hoff, Rubber Lined, with 40 HP Motor.

PUMPS — SAND
6—2" Wilfley-Rubber Lined-Motorized.
1—1½" Denver Equipment, Vertical—Motorized.

SLUSHER HOISTS
1—D Drum Ingersoll-Rand Electric Slusher Hoist, with two 1½ Yard Crescent Scrapers.

CRUSHERS
1—9" x 40" Austin-Western.
1—10" x 20" Allis-Chalmers.
1—24" x 20" Jeffrey Swing-Hammer Mill.

THICKENERS
1—20' x 8' Dorr—Fir Tank.
1—20' x 8' Booth-Thompson—Fir Tank.

FLOTATION MACHINES
4—#24 Denver Sub-A, 8 Cell, Wood Tanks.
1—#18 Weinig Sub-A Cell, Steel Tank.
1—#12 Denver Sub-A, 6 Cell Steel Tank.

REAGENT FEEDERS
1—Geary, Jr., 2-Bucket, with Motor.
14—Clarkson Model E (wet), with Motors.
1—Denver Equip. (wet), Single Compartment.
1—24" Cone Type Denver Equip. (dry), with Motor.
1—Jeffrey-Traylor, Vibrating Type.

BALL MILLS
1—#45 Marcy.
1—#64 Marcy.
1—6' x 7' Allis-Chalmers.

TANKS
1—8'6" dia. x 29'6" Open Top Army Bolted Steel Tank—Cap. 44,000 gals.
2—20' x 20' Wood Stave Tanks.
1—10' dia. x 20' Wood Stake Tank, Cap. 22,500 gals.

FILTERS—DISC
3—4', 6-Disc Elmco Filters.

CONCENTRATING TABLES
4—6' x 16' Deister Type, New Rubber Decks, Motorized.
1—6' x 16' Butchart, New Rubber Decks, Motorized.
1—#13-B Laboratory, size 50" x 24", Motorized.

AGITATORS
3—10' x 9' Devereaux Type Center Well, Rubber Lined.

AIR COMPRESSORS
1—8⅜ x 4¾ x 5 Chicago—Pneumatic, V-belted to a D-4400 Caterpillar Diesel Engine.
2—445 Cu. Ft. Imperial Type 10, with 75 HP, AC Motors.

BULLETIN NO. 9 AND UTAH LIST SENT UPON REQUEST

FLORENCE MACHINERY & SUPPLY COMPANY

C. J. Parrish, Mgr., Suite 904, Equitable Bldg., Denver 2, Colo. Phone: Al 2803

FOR SALE

1—1200 cu. ft., 2 stage, I.R. Stationary Air Compressor. Req. 200 HP motor.
2—350 cu. ft. I.R. type ER1 Plate valve air compressors. Req. 60 HP motors.
1—54" x 22' Duplex Door Classifier.
1—36" Telsmith Model 8B Gyratory Crusher, late model, like new; also 25 HP motor and V-Belt Drive.
1—15" x 24" Universal Jaw Crusher. Requires 50 HP motor.
1 set—36"x16" A.C. Type B Crushing Rolls.
1—65 HP, 1200 RPM, Model UD14 International Diesel Engine, direct connected to 37½ KVA 3 phase, 60 cycle, 440/220/110 volt Palmer Generator.
1—50 HP D. D. Electric Mine Hoist.
1—50 HP S. D. Electric Mine Hoist.
2—Sullivan 2000 lb. Model F113 Air Hoists.
1—I. R. Model H.U. Tugger Air Hoist.
1—4' x 9' Marcy Ball or Rod Mill, 50 HP motor and V-Belt Drive.
1—55' x 12' Hardinge Super Thickener and Clarifier Mechanism, Steel Superstructure, overload alarm, gear motor and worm gear drive.
1—4' x 22' Bodinson Trommel Screen.
1—40" x 18' Bodinson Trommel Screen.
Large stock of Pumps—Air Drills—Steel—Etc.

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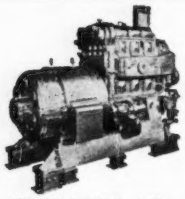

DIESEL GENERATOR PLANTS FOR IMMEDIATE DELIVERY

HEMCO

1000 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 16-278A
750 KW, 2400 Volts, 3 Phase, 60 Cycle, 720 RPM, General Motors Model 12-567
600 KW, 2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
300 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8-268A
200 KW, 450/2400 Volts, 3 Phase, 60 Cycle, 1200 RPM, General Motors Model 8268A
50 KW, 440 Volts, 3 Phase, 60 Cycle, 900 RPM, airbanks-Morse Model 36A 5½
100 KW, 3 Wire, 125/250 Volts DC, 1200 RPM, General Motors Model 3-268A
900 HP, General Motors Model 12-567, Propulsion Unit Complete

HERCULES ELECTRIC MACHINERY and EQUIPMENT CO.

Tel. NEvada 6-2808—Cable Address HEMCOY 1412-18 So. Alameda St., Compton, Calif.

MINE HOIST: All steel construction, single drum, 8' dia., 3700 ft. 1½" rope, single line pull capacity 73,000 lbs. with herringbone gears to operate at a speed of 200 or 600 FPM; motor 400 H.P., 580 RPM, 3 phase, 60 cycle, 2200 volt, complete with all control equipment. Condition like NEW. Located in California.

GOODRICH SUPER LONG LIFE CORD CONVEYOR BELT (NEW):
1—Piece 1014 ft.
1—Piece 1017 ft.
1—Piece 258 ft.
6 ply, 42 oz. duck, 7/32" top cover, 1/16" bottom cover, on original reels.

ALL NEW, NATURAL RUBBER. With or without mechanical parts.

TURBO GENERATOR: Curtis Steam Turbine driven Generator Unit, 600 KW, 5 stage, 200 lbs. steam pressure, 3600 RPM, with condenser, General Electric Generator, 750 KVA, 2300 volt, 3 phase, 60 cycle, with exciter, piping, valves, etc.

PUMP: Worthington 40 H.P. steam driven Centrifugal Pump 300 lbs. steam pressure, 3550 RPM, with steam regulator. Complete, in new condition.

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Stationary • Portable
Electric • Gas • Diesel • Steam
Rebuilt • Tested • Guaranteed
All Sizes • PROMPT SERVICE

AMERICAN AIR COMPRESSOR CORP.

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DIESEL POWERED PUMPS

Hercules and Buda engines with Gardner-Denver and Allis Chalmers all bronze pumps. Slightly used as standby fire protection by U.S. Navy. 100 H.P. with 1000 g.p.m. at 140 pounds pressure pumps. These pumpers are serviced and ready to use. Full details and specifications on request.

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Irrigation Division
Forestdale, Cape Cod, Mass.

6 FT. X 48 IN. HARDINGE BALL MILL, WITH OR WITHOUT AIR SEPARATOR

#1½ STURTEVANT RING ROLL MILL.
54 IN. X 30 FT. ROTARY DRYER.
3 FT. X 5 FT. HUMMER 3 DECK SCREEN.
24 FT. X 48 IN. LINK-BELT APRON FEEDER.
40x48 BUCHANAN JAW CRUSHER.
36 IN. X 24 IN. TRAYLOR JAW CRUSHER.
70 IN. X 35 FT. RUGGLES COLES XB INDIRECT DRYER.
8 FT. & 10 FT. GAYCO AIR SEPARATORS.
45-TON PLYMOUTH DIESEL LOCOMOTIVE.

DARIEN CORPORATION

60 E. 42nd Street, New York 17, N. Y.

MOTORS, GENERATORS, TRANSFORMERS
1 — 1500 H.P.
Bought and Sold
New and Rebuilt
ELECTRIC EQUIPMENT CO.
ROCHESTER 1, N. Y.

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Used Equipment — Ball Mill

One 4' x 4' Allis Chalmers ball Granulator complete with motor drive and coupling (no motor). Has been used approximately 8 months since time of purchase. For full particulars wire or phone:

E. T. McGrath
Pittsburgh Metallurgical Co., Inc.
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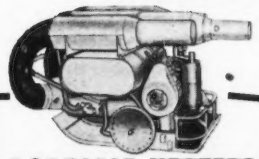
HOIST FOR SALE

200 HP single drum 8' dia x 5'6" long, with automatic electric controls and air operated post brake. Change in location makes this excellent hoist available.

G. & W. H. CORSON, INC.
Plymouth Meeting, Pa.

SALE



PORTABLE HEATERS

Complete with flexible ducts. Excellent operating condition guaranteed.

Especially Adaptable for

MINE USE

STEWART-WARNER portable, powerful 100,000 BTU gasoline-burning Heaters complete with turbine type blower and 1½-hp. air-cooled, ball-bearing engine.

PORTABLE SELF-POWERED MANY PURPOSE HEATER

HEATING—Mills, Bunkhouses, Dry Rooms, Large Boarding Houses, Shops, Sheds, Warehouses, Buildings Under Construction, Spot Heating, etc.

THAWING—Thawing Frozen Ore, or Preventing Freezing in Ore Bins, Thawing Frozen Areas, Machinery, Pipe Lines, Tanks, etc.

DRYING—Drying Concentrates or Ore in Conjunction with Tumbler. Dry Wet Ore in Bins; Dry Plaster, Paint, Mortar, etc.

PRE-HEATING—Engines, Tractors, Trucks, Equipment, etc.

ORIGINAL COST $583.00

SALE PRICE $195.00

Electric Heaters also in Stock.

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"#" FOR QUALITY EQUIPMENT

STEEL STORAGE BINS—HOPPER TYPE—1—66′ long, 16′ wide, 10′-6″ high straight side, 6′-6″ height of hopper, 6 compartments.
1—11′ long, 8′-9″ wide, 10″ high straight side, 6′-6″ height of hopper, 2 compartments.
1—88′ long, 12′ wide, 7′ high straight side, 6′ height of hopper, 8 compartments.
3—34′ long, 12′ wide, 6′-6″ high straight side, 9′ height of hopper, 4 compartments.
1—22′ long, 11′-6″ wide, 7′-3″ high straight side, 6′-3″ height of hopper, 4 compartments.
1—44′ long, 14′-2″ wide, 9′-6″ high straight side, 7′-7″ height of hopper, 4 compartments.

STACKS—3—5′-3″ dia. x 110′ high, ⅜′ and 5/16″ plate with reinforcing bands every 10′8″. 92—30″ diameter x 30′ high.

MULTIPLE HEARTH FURNACES—2—Continuous gas fired, air cooled. Mfd. by Allis Chalmers. 24′-7″ dia. x 33′ high. Complete with Mixers, heater unit, base and power drives. (1 Never Used—1 Slightly Used.)

GAS PURIFICATION SYSTEM—Complete with tanks, valves, piping; capacity 2,000 to 16,000 cu. ft. per hour.

FULLER-KINYON SYSTEM — Type H5 Pump with Motor and Feed Hopper, hi-low system, 250′ 4″ pipe and 8—3-way motorized valve.

CHRYSLER AIRTEMP — 2—NEW 75-ton units complete with Trane Evaporative Condensers, Fans and Motors.

JEFFREY SWING HAMMER PULVERIZER—36″ x 24″, Type A-2, with 50 HP TEFC Motor.

AIR COMPRESSORS—8—C.P. 12″ x 10″ NSB, 266 CFM, 100# pressure.

OLIVER CONTINUOUS FILTER—5′4″ dia., 6′ face, serial #8823, complete with all accessories.

AUTOCLAVE—Vertical, jacketed, stainless steel lined, 6′0″ x 8′ x 11/16″ shell, 40# W.P., ASME U-69.

BLENDERS
3—NEW Conical copper 2.7 cu. ft. cap., 20″ x 20″, with reducer and motor.

BLOWERS
4—18,000 CFM 7¾″ SP V-Belted Type SE, #12 American.
6—10,000 CFM 1.9″ SP Everdur Blades, Type R Buffalo.
1—5,750 CFM 7½″ SP American.
3—3,300 CFM ¾″ SP with motors.
6—1,200 CFM 13.9″ SP with motors.
3—1,000 CFM ⅜″ SP with motors.

CONVEYORS—BELT
30″ Troughing, 65′ centers, stainless Belt with reducer & 5 HP TEFC motor.
24″ Flat 30′ centers and drive.
24″ Troughing, 20′ centers and drive.
18″ Troughing, 22′ centers and drive.
Barber Greene complete loading conveyor, 24″, 18′ troughing type with rails and drive.

DRYER
1—Unused Proctor-Schwartz Conveyor.

ELEVATORS—BUCKET
48′ centers, single 825 chain, 14″x7″, MI Buckets, steel encased.
68′ centers, single 825 chain, 10″x6″, MI Buckets, steel encased.

FILTERS
1—#12 Sweetland, 72 leaves, 2″ spacing, 37″ dia., 145″ long, 1,000 sq. ft. filter area.
1—Celeron, 36″, 4-eye, washing type, 52 chambers, 60# pressure.
2—Unused Shriver, rubber covered, 24″ closed delivery, 4-eye, 3.61 cu. ft. cap., manual closing.

MILLS
Stedman, 4-cage, 36″ with motors.
Mikro Pulverizer, #2 belt driven.
Day 3-roll 16″x40″ Ink Mill.
Raymond 3-roll, low side.

MIXERS
Blystone, heavy duty, 4′x6′ with motors.
Readco #1½ SA, motor driven.
Champion #2 Type E motor driven.
Champion #3 Super Ajax, motor driven.

MOTORS
Large quantity NEW Gear Motors and X.P. from ½-75 HP.

PUMPS
Frederick Iron & Steel Co. 8″ DSV-SM, 2,500 GPM, 150′ H., comp. with 125 HP, TEFC Motor and Control Panel.
Chicago 4″x4″ 500 GPM, 88′ H., C.I.
Allis Chalmers, 2½″x2″, 200 GPM, 140′ Head.
F.M. 3″x3″, 300 GPM, 100′ Head.
Deming, bronze, 3″x2″, 150 GPM, 50′ H.
Duriron, 4″x3″, 290 GPM, 90′ Head.
Duriron, 3″x2″, 300 GPM, 108′ Head.
Wilfley, S.S., 3″x2½″, 150 GPM, 100′ H.
Stokes, Hi-Vacuum, 100 cu. ft. with 5 HP drive.

TANKS
5,000 gals. hor., 6′1″x24′x½″.
5,000 gals. hor. 6′x23′7″x5/16″ (NEW).
4,000 gals. hor. 6′x20′x5/16″ (2 NEW).
3,500 gals. hi-chrone 77″x10′x⅜″.
2,300 gals. hor. 5′x15′x½″.
750 gals. vert. 5′x8′x½″ open.

WELDERS
300 and 400 amps., G. E. & Hobart.

MISCELLANEOUS

ABSORBER — 260,000 gals., 22′ dia., 90′ high, vert.

BOILER PLANT—Complete, Erie City, 604 HP, 180 PSI, ASME code and Natl. Board. Pulverized coal fired, with coal bin and bucket elevator.

COOLING TANKS — 2—Vert., 12′6″x45′, 5/16″ & ⅜″ plate. (2 avail.)

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SCRUBBER TOWER — 16′x39′x⅜″ shell and dome, ½″ bottom.

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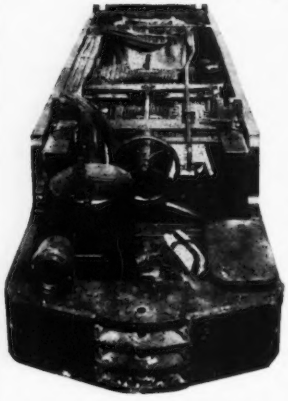

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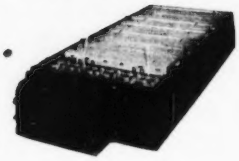

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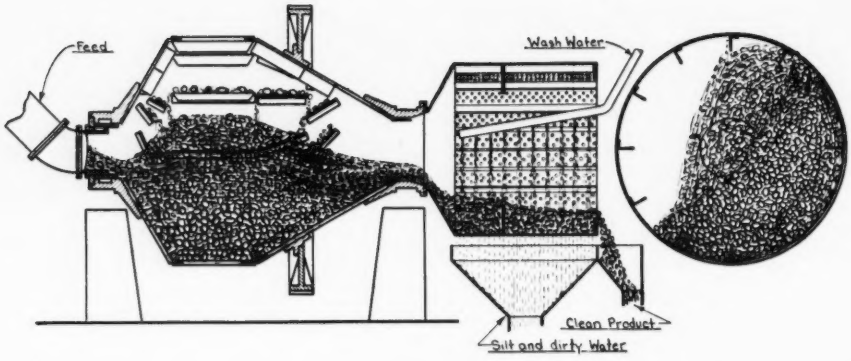
Wickwire Rope, Grinding Rods, Industrial Screens, Mine Rails and Fastenings, Realock Fence, Clinton Welded Wire Fabric, Grader Blades and other Cutting Edges

CF&I FORGED STEEL GRINDING BALLS
The Colorado Fuel and Iron Corporation
General Offices: Denver, Colorado
PACIFIC COAST SALES — THE CALIFORNIA WIRE CLOTH CORPORATION — OAKLAND, CALIFORNIA

What is MASS ACTION *in ore scrubbing?*

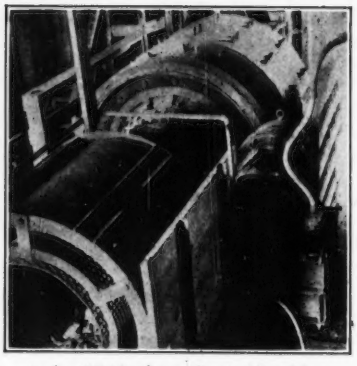


HARDINGE CONICAL SCRUBBERS

"Mass Action" in a Hardinge Conical Scrubber is similar to the effect obtained by rubbing a handful of pebbles between the palms in a bucket of water.

The Conical Scrubber is used to remove adhering clay, silt, etc., from ores, phosphate rock, gravel, and many other material. Its high speed, along with the mixing effect of the lifters and the deep mass of material in the shell, produce a very strong scrubbing action between the heavily-weighted bottom layers of materials. The classifying action of the cones hold back the larger lumps of clay or dirt until disintegrated. Final separation takes place in the rotating washing screen at the discharge.

This scrubber is capable of removing very hard clay in a very short time without excessive wear in the scrubber itself. Write for Bulletin 37-A-1.



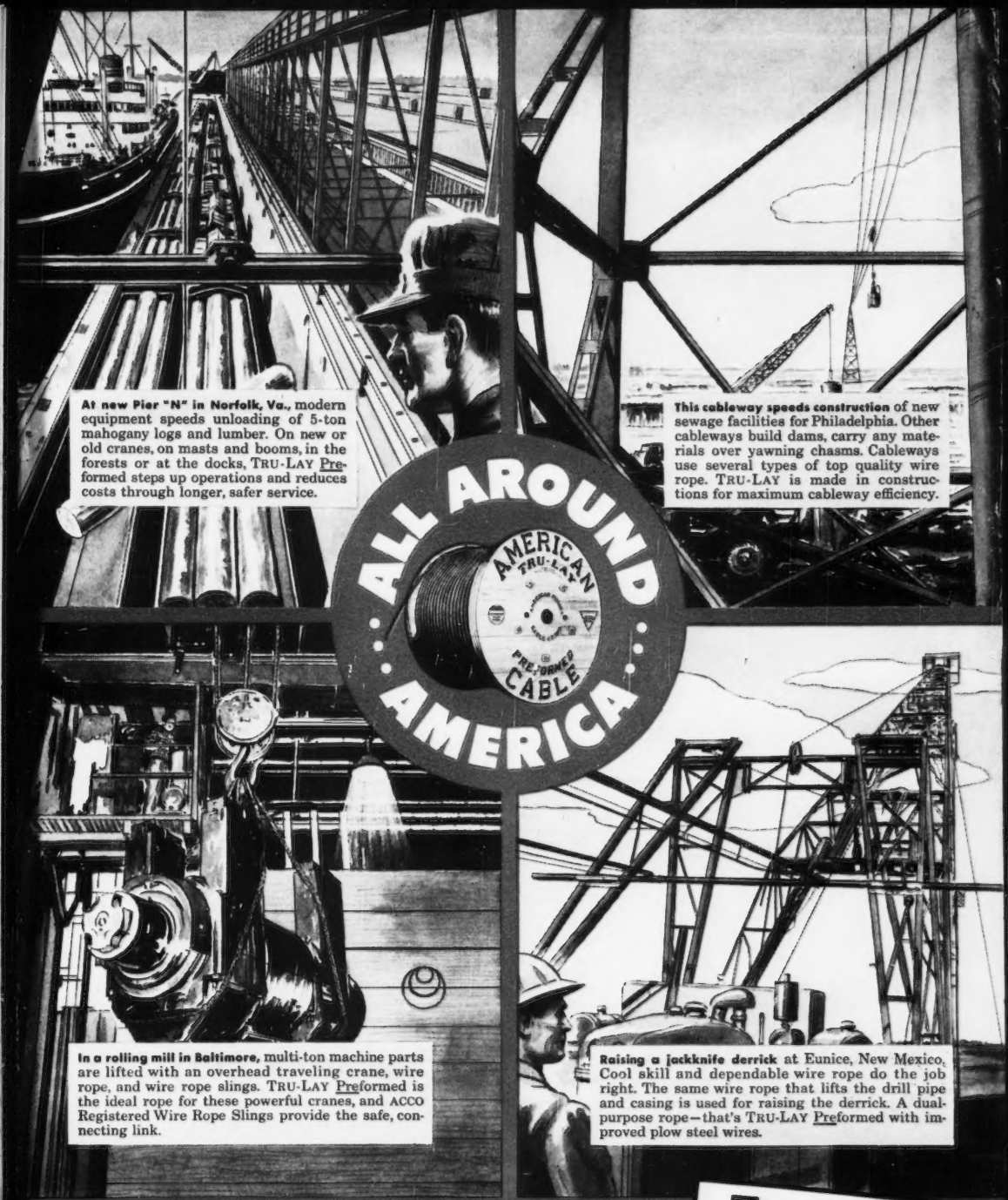
A 6' x 48" Hardinge Conical Scrubber washing clay balls from gold ore.

HARDINGE

COMPANY INCORPORATED

YORK, PENNSYLVANIA — 240 Arch St. • Main Office and Works
NEW YORK 17—122 E. 42nd St. • 205 W. Wacker Drive—CHICAGO 6
SAN FRANCISCO 11—24 California St. • 200 Bay St.—TORONTO 1

CONICAL MILLS | COUNTER CURRENT CLASSIFIERS | THICKENERS CLARIFIERS | RUGGLES COLES DRYERS | CONSTANT WEIGHT FEEDERS | TUBE ROD AND BATCH MILLS



At new Pier "N" in Norfolk, Va., modern equipment speeds unloading of 5-ton mahogany logs and lumber. On new or old cranes, on masts and booms, in the forests or at the docks, TRU-LAY Preformed steps up operations and reduces costs through longer, safer service.

This cableway speeds construction of new sewage facilities for Philadelphia. Other cableways build dams, carry any materials over yawning chasms. Cableways use several types of top quality wire rope. TRU-LAY is made in constructions for maximum cableway efficiency.

In a rolling mill in Baltimore, multi-ton machine parts are lifted with an overhead traveling crane, wire rope, and wire rope slings. TRU-LAY Preformed is the ideal rope for these powerful cranes, and ACCO Registered Wire Rope Slings provide the safe, connecting link.

Raising a jackknife derrick at Eunice, New Mexico. Cool skill and dependable wire rope do the job right. The same wire rope that lifts the drill pipe and casing is used for raising the derrick. A dual-purpose rope—that's TRU-LAY Preformed with improved plow steel wires.

ACCO

Wilkes-Barre, Pa., Atlanta, Chicago, Denver, Houston, Los Angeles, New York, Philadelphia, Pittsburgh, Portland, San Francisco, Seattle, Tacoma, Bridgeport, Conn.

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In Business for Your Safety

Tru-Lay *Preformed* **Wire Rope**

You Have The Rock

We Have The BIT

Get them together and you will have the formula for greatly reduced drilling costs. It doesn't matter what kind of rock it is; there's a Timken Rock Bit to match and master it—including a carbide insert bit.

What makes the Timken Bit superior for rock drilling? (1) a removable principle that has proved its correctness by more than 14 years service under all rock drilling conditions in mines and construction work. (2) Timken Steel developed especially for Timken Rock Bits and produced in our own steel plant. (3) Timken metallurgical "know how" in heat treatment and hardening. (4) uniform quality and performance; every Timken Bit will give the same outstanding service in speed of penetration and depth drilled when used in the same kind of rock.

No matter where you are there's a Timken Rock Bit distributor within telephone call. Conversion and reconditioning shops also are conveniently located for quick service. Put Timken Bits to work now—cut drilling costs, increase production.

THE TIMKEN ROLLER BEARING COMPANY, CANTON 6, OHIO
CABLE ADDRESS "TIMROSCO"

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ROCK BITS